FLYING

ROBERT O. HABERSTROH

... BEFORE I BUY A PLANE...

by JOHN H. GEISSE

SEE PAGE 30

FEBRUARY
1945
35c
In Canada 40c

Faster and Fresher via Cyclones

Transportation of perishables by air becomes a highly interesting prospect as ton-mile costs shrink. Yet no commodity under consideration is so perishable as human vitality, which on extended trips wilts like lettuce or gardenias.

Faster, Cyclone-powered air transport gives passengers a wide travel advantage in distance covered before fatigue sets in. With still higher standards of commercial speed in sight for tomorrow, transportation to any part of the world will be possible with maximum saving of passenger vitality.

The accepted high-power engine for super-speed transport in such installations as the Boeing Superfortress, Lockheed Constellation, Curtiss CW-20E Commando and Martin Mars is the Cyclone 18, with a rating of more than 2200 horsepower. True to Wright tradition, the smooth-running Cyclone 18 is thrifty of fuel and maintenance, and offers operators a payload bonus of two extra passengers over comparable power plants. *Wright Cyclones pay their way.*

Cyclones Save 3 Ways

LESS WEIGHT—MORE PAYLOAD
LOWER FUEL CONSUMPTION
REDUCED MAINTENANCE

WRIGHT

Aircraft Engines

Wright Aeronautical Corporation
A Division of Curtiss-Wright Corporation
Paterson, New Jersey, U.S.A.

WRIGHT POWERS THE TONNAGE OF THE AIR

Wheels "land" here at 100 miles per hour

A typical example of B. F. Goodrich development in rubber

A GIANT BOMBER weighs as much as a freight car. And no one has yet discovered a way to let it down at low speed. Its tons of weight may sweep the field at 100 miles an hour. Tires scream and smoke. As they spin faster and faster, they "grow"—they actually increase in size.

Engineers needed to see all this in a close-up—a worm's-eye view at 100 miles an hour—to study what happens to tires and how to improve them. They couldn't do this on the field. So B. F. Goodrich men brought the field into the laboratory.

The large wheel is set spinning electrically until the speed of its surface equals the landing speed of the plane. Then it is allowed to "coast." The tire is pushed against this whirling runway at exactly the pressure the plane would put upon it. Every action of the tire can be watched and recorded.

B. F. Goodrich developed the device, working with a machinery manufacturer who then sold similar machines to the Army air forces and other rubber companies.

It has brought many improvements in airplane tires . . . and airplane brakes. In the same way, B. F. Goodrich "brings highways indoors" to develop better tires for passenger cars, trucks, farm implements, buses and other vehicles. Engineers can study the effects of speed, of braking.

One of the results of this extra care in research is today's all-synthetic B. F. Goodrich Silvertown. Backed by three years' *extra* synthetic tire experience, it has now rolled up more than 7 *billion* miles in actual service. *The B. F. Goodrich Company, Akron, Ohio.*

B.F. Goodrich
RUBBER *and* SYNTHETIC *products*

FEBRUARY, 1945

VOLUME 36 • NUMBER 2

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MILITARY

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ENGINEERING

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BUILDING VERTICAL SKYWAYS

By WAYNE W. PARRISH

Publisher of "American Aviation" tells of Bell Aircraft's progress in helicopter development

"IN my estimation it will be some time before flying around the country in a helicopter becomes widespread. However, great strides are being made in the development of rotary wing aircraft. One outstanding achievement is Bell Aircraft's new helicopter which, largely through *two* ingenious innovations, has made possible both stability and precision control.

"One innovation is a two-bladed rotor, supported on a universal joint so that it is free to 'see saw' and at the same time to turn on its longitudinal axis. The second is a bar which, gyroscopically, tends to keep the rotor in its plane of rotation regardless of the position of the mast. This is a basic Bell Aircraft patent which works for stability under all conditions. It is found only in the Bell helicopter.

"The Bell helicopter represents a type of aircraft men have long wanted. It can take off and land on a very small plot of ground, and even in winds of nearly gale force it can fly up, down, backwards, forwards and sidewise—and still remain stable and under perfect control.

"When ceiling and visibility are too poor for a fixed wing plane to fly—then it's 'helicopter weather'—for the helicopter can slowly, safely feel its way through murk or fog.

"The helicopter will have many important industrial uses in the postwar world. Plans are already being formulated for its use in crop dusting, forest fire patrol, pipe line patrol, emergency rescue work, feeder taxis for airlines, executive travel, and many other peacetime applications.

"When this progressive company can turn its skills and resources to producing peace-time needs, look to the Bell helicopter to be one of the leaders in the postwar aviation field."

★ *Buy War Bonds and Speed Victory* ★

"Just have to keep on livin', ma'am—"

The U.S.O. hostess recognized wings, and rank, but the face was too young for the silver leaf on his shoulder.

"Heavenly day!... How do you Air Force boys run up so much rank so fast?" she asked.

"You just have to keep on livin', ma'am," said the youthful 8th Air Force Lieutenant Colonel . . . and he wasn't being at all facetious!

SINCE last summer they have been trickling back . . . with rows of ribbons under their wings, foreign service stripes, and the shoulder patch with the "8" between the spread wings of the Air Forces emblem. Too few of us know either the marking or its meaning.

The 8th Air Force began with the first few Flying Forts sent to England in early 1942... proved that precision bombing by day was practical—and deadly... fought with the R.A.F. 500 miles deep in Fortress Europe despite 40,000 anti-aircraft guns, Focke-Wulfe fighters ...and sickening losses to the original group.

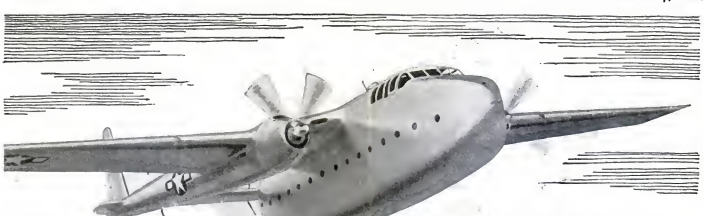
With 1943 came reinforcements; but the Ploesti oilfields cost 54 bombers, the two Schweinfurt raids 96. Before the year's end, 60% of the flying personnel were dead, wounded, listed as missing, prisoners of war. At its peak in Spring 1944, the 8th lost in one fateful week in February 170 bombers, downed 548 German fighters, broke the back of the vaunted Luftwaffe.

In a year of hard, persistent fighting, the 8th battered the German war machine and its industries, shriveled Nazi nerves. When D Day came, American armies never met the full strength of the mighty Wehrmacht, but an enemy weakened by disorganized communications and supply lines.

What most Americans fail to realize is that the 8th Air Force saved the lives of hundreds of thousands of doughboys, shortened the European war by perhaps a year . . . earned more decorations and citations than any other military unit in history, as well as our undying gratitude. Watch for the 8th shoulder patch and honor the men who so proudly wear it!

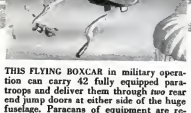
MANY of the 8th Air Force and other AAF bombing personnel were schooled in twin-engine training planes powered with engines made by Jacobs... a fact of which we are justly proud . . . Jacobs Aircraft Engine Company, Pottstown, Pa.

JACOBS · Pottstown, Pa.



FAIRCHILD ANNOUNCES
The PACKET
FOR AIR CARGO

THIS FLYING BOXCAR in military operation can carry 42 fully equipped paratroops and deliver them through two rear end jump doors at either side of the huge fuselage. Paracans of equipment are released through bomb bay doors beneath the plane.



LOADING MADE EASY, another Packet feature. A huge split door in the stern, a smaller freight door forward simplify loading and unloading of cargo. The cargo floor parallels the ground *at loading truck floor level* eliminating the need for hoisting devices.

OVER 3,500 MILE RANGE means speedy delivery of vitally needed supplies in military operations—cargoes measured, not in pounds, but in *tons*. Today, for the Army; tomorrow, it's yours!

The PACKET is designed *specifically* to transport cargo and troops by air...to carry boxcar loads at air express speed. It was born of a wartime need. The Army presented the problem to Fairchild engineers:

Build a plane that can utilize average airports and fly long or short distances economically—a plane with huge cargo capacity, for men, guns, trucks, ammunition or equipment.

Such a plane is The PACKET. It is in the air today, the first of many to undergo rigid flight tests. An all-metal, high-wing monoplane, The PACKET is powered by two 2100-horsepower engines. It is designed to operate with the simplicity and economy of twin-engine airplanes.

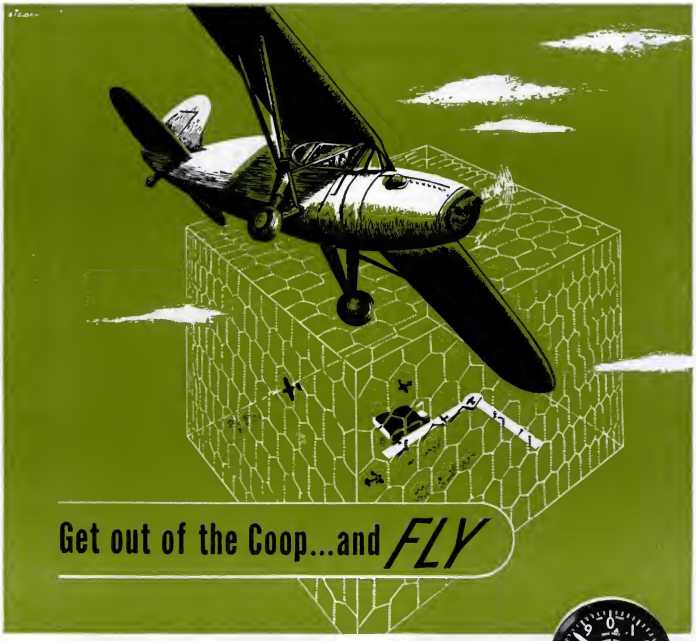
Fairchild engineering experience has given The PACKET another invaluable quality. While today it can carry the weapons of war, tomorrow, with but minor modification, it can transport the goods of peacetime commerce.

It has the characteristic inherent in all Fairchild products—the "touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

Fairchild Aircraft

Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland



The greatest enjoyment and benefit in owning a plane lies in *going somewhere!* If lack of proper instruments—reliable instruments—keeps you cooped up in the vicinity of your airport, you're missing most of the things you own a plane for! An adequate set of instruments for cross-country flying — and, incidentally, to take you through low-visibility areas—is a small investment compared with the added usefulness they give your plane.

* * *

Write today for "Facts About Kollsman Instruments" and what they contribute to the safety, enjoyment and utility of flight. Kollsman Instrument Division, Square D Company, 80-02 45th Avenue, Elmhurst, New York.

"Kollsman" is the standard of accuracy on the airlines of the nation!

This is the Kollsman Sensitive Altimeter with which most of the nation's airliners are equipped and upon which they depend for safe flying procedures. The Kollsman Instruments you'll buy for your own plane will be just as dependable.

KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

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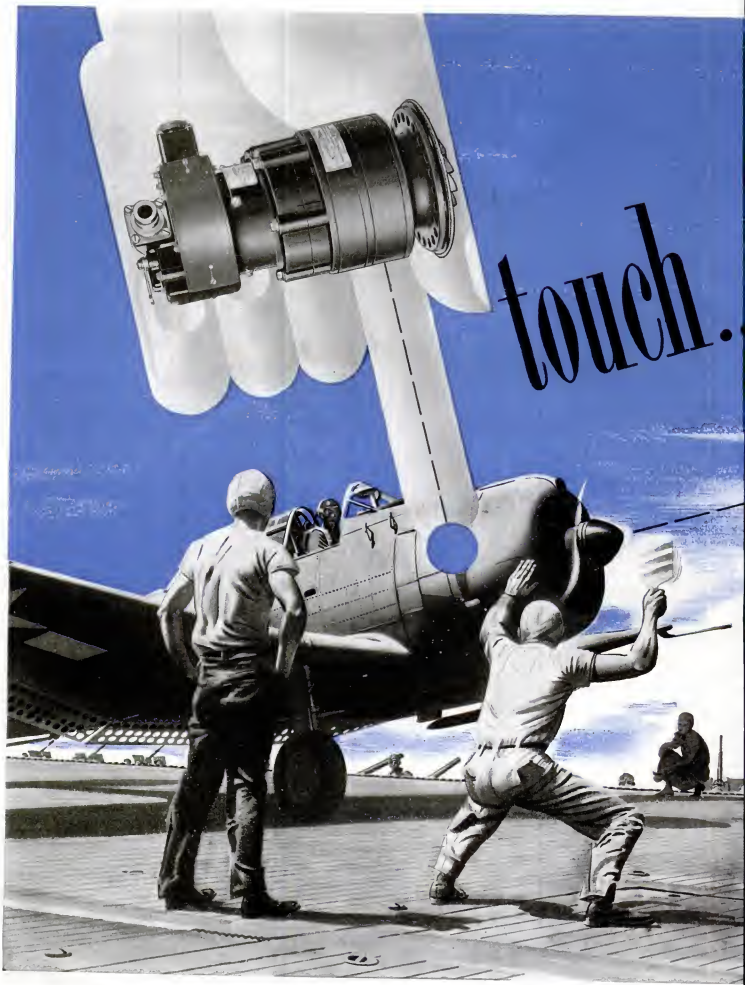

touch..

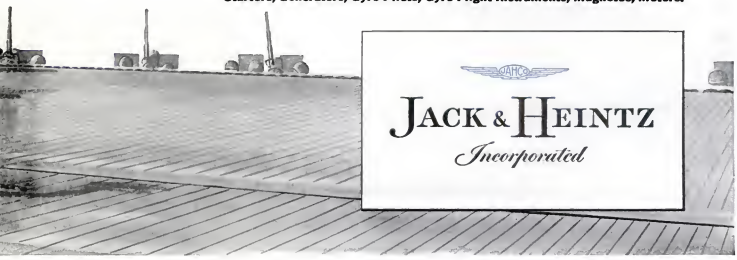
"Enemy aircraft approaching!" . . . and it's *touch and go* for the flattop fighters! Out where a delay of seconds could sink the ship, Jack & Heintz starters are famous for sure-fire performance. And wherever *touch* and *go* starting is vital . . . in arctic cold or tropic heat or desert sands . . . these starters are pitting terrific stamina against the toughest battle conditions.

Brush life, for example has gone up from 500 cycles of operation to 17,000. Operating range is now from 65 below zero to 165 in the sun. Jack and Heintz engineering has cut starter weight in half . . . and boosted starter life far beyond previous records.

These improvements . . . and others like them in the automatic pilot, in flight instruments, generators and retraction motors . . . are traceable to two distinct Jack & Heintz assets: an engineering staff that begins where usual thinking stops; and manufacturing techniques and revolutionary methods that set completely new standards in precision production.

So valuable in war, this ability . . . these methods hold great new things in store for peacetime aviation. Watch for the fulfillment of their promise.

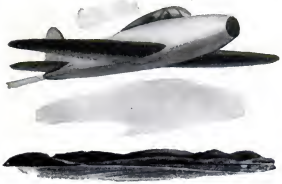
Jack & Heintz, Inc., Cleveland, Ohio, manufacturers of Aircraft Engine Starters, Generators, Gyro Pilots, Gyro Flight Instruments, Magnetos, Motors.



What kind of airplane will you fly?

1 Roadable aircraft would be handy. With wings folded they could be kept in garages, driven to airports. The lighter but more powerful engines that Standard of California's great high-octane gasoline will make possible, would be ideal for these double-duty ships of the future.

2 You'll probably wait a little longer for fast, easy-to-fly jet-propelled aircraft. But Standard has already made special fuel for military models; and when commercial versions go aloft, Standard scientists will have an improved fuel to make the most of jet economy and performance.



3 Plenty of level-headed people are starry-eyed over helicopters. These planes will be even better in a few years. And when civilian models *do* appear, there'll be a Standard Aviation Gasoline exactly right for their motors. War has taught us much about "tailoring" fuels to engines.

4 But your *first* post-war plane will look more like this. It probably won't be built for 100-octane fuel, but it *will* have lots more power and endurance, thanks to the great new Standard Aviation Gasoline that wartime research has perfected now—for the aircraft of tomorrow.

STANDARD OF CALIFORNIA

STANDARD
AVIATION
PRODUCTS

A peacetime plane that was "built to order"

FOR THOUSANDS OF AMERICANS

Easy to Fly . . . Easy to Own . . .

THOUSANDS have answered the popular Bellanca Aircraft Quiz, and still the returns roll in! They show increasingly that The Bellanca Cruisair, as produced prior to the war, approached the ideal peacetime personal plane that America's flying public has in mind.

The leading answers indicate that the flying public wants a three to four place low wing monoplane with retractable landing gear, equipped with a 120 to 150 hp air-cooled opposed engine and gross weight in the 1500-2000 lb. bracket — all features which the Bellanca engineering organization had anticipated and incorporated in the pre-war Cruisair. The Cruisair's top speed of 150 mph, cruising speed of 130 mph, and landing speed in the 40-50 mph range come within the performance preferences expressed by the majority. Typical Bellanca efficiency provided extreme economy of operation—22 miles per gallon of fuel, at better than two miles per minute cruising speed.

The Quiz returns are voluntary—they give a pattern of the ideal specifications and requirements of the airplane which will most closely approach the desires and wishes of the majority! These results indicate that The Bellanca Cruisair was practically "built to order" for the thousands who are now planning their post-war flying.

WRITE NOW FOR THE QUIZ!

You still have time to enter the Bellanca Aircraft Quiz and register *your* views on the many airplane features listed. Just send your name and address—no obligations—and we'll mail your printed copy of the Quiz promptly.... Bellanca Aircraft Corporation, New Castle, Delaware. Dept. S-1

The BELLANCA *Cruisair*

3 **11:20 p.m. Thursday:** The Liberator contacts the control tower at its California airport . . . "CONSAIRWAY plane No. 10 coming in!" . . . and it's back home again. Since it left that same airport, 95 hours and 20 minutes ago, the land-based Liberator Express has logged 14,690 miles over the Pacific—to Australia and back!

6 **After the war,** long-range Liberator planes will continue to supplement other forms of transportation—the train, truck, and ship—in rebuilding the peacetime world. But airplanes will also have *another* role to fulfill: a permanent postwar Air Force can become America's soundest investment in the interests of a lasting peace.

No spot on earth is more than 60 hours' flying time from your local airport

From "Flying Jeeps" to Leviathans of the air — The planes shown below were all designed and developed by Consolidated Vultee. When peace comes, the company will be in a position to provide the postwar equivalent of such planes, from small, privately owned "air flivvers" to huge, transoceanic cargo-and-passenger planes.

LIBERATOR . . . 4-engine bomber

LIBERATOR EXPRESS . . . transport

CORONADO . . . patrol bomber

CATALINA . . . patrol bomber

VENGEANCE . . . dive bomber

VALIANT . . . basic trainer

RELIANT . . . navigational trainer

SENTINEL . . . "Flying Jeep"

QUICK FACTS FOR AIR-MINDED READERS

Atlantic "Millpond" — So far, during the war, Allied aircraft have flown more than 15,000 Atlantic Ocean crossings.

* * *

Life Saver—Probably one of the smallest warplanes in use, the famous Consolidated Vultee "Flying Jeep" has added a new job to its many other uses. Modified as a flying ambulance (*capacity: 1 litter*) it is speeding wounded men to base hospitals from small jungle clearings and other inaccessible spots.

* * *

Postwar "sky roads"— 20,000 air strips, placed 10 miles apart in a pattern of squares, would cover the country. Adequately marked, they would enable the postwar small-plane owner to travel cross-country without learning a complicated system of navigation. Cost per strip: $6000 (*about ¼ the cost of 1 mile of national highway*).

* * *

"It is becoming increasingly clear to an air-minded America that a greatly expanded Air Transport, a permanent postwar Air Force, and a healthy, competitive Aircraft Industry will be important factors in helping to maintain a lasting peace and prosperity." Tom M. Girdler, Chairman of the Board, Consolidated Vultee Aircraft Corporation.

Consolidated Vultee is the largest builder of airplanes in the world.

CORPORATION

San Diego, Calif. · Vultee Field, Calif. · Fairfield, Calif. · Tucson, Ariz. · Fort Worth, Texas · New Orleans, La. · Nashville, Tenn. · Louisville, Ky. · Wayne, Mich. · Dearborn, Mich. · Allentown, Pa. · Elizabeth City, N. C. · Miami, Fla.

Member, Aircraft War Production Council

The Martin Mars Stands for Safety!

CLIMBING ON 2 ENGINES: Demonstrating it's high safety factor, the 72-ton Martin Mars gains altitude with 2 of it's propellers fully feathered.

WHO will be tomorrow's overocean airline passengers? Recent surveys tell us that 45 is the approximate age at which the greatest number of airline trips are taken. Thus it seems likely that the majority of tomorrow's overocean passengers will be successful business men and middle-aged tourists who have earned the time and money to travel abroad. Older, more conservative, they will probably be swayed by considerations of safety—will undoubtedly prefer flying boats, like the Martin *Mars*, for transocean air travel.

Mars Transports Stress Safety

As a flying boat, the *Mars* possesses greater inherent safety than landplanes for extended overocean trips. Then, too, its huge size and strength give the added assurance that if forced down it could cope successfully with heavy waves. More, it has demonstrated its ability to remain aloft on only 2 engines, its wings are sufficiently thick to permit the crew to service the engines while in flight, and the most modern safety devices of every sort have been incorporated in its design. In safety, as in payload and low operating cost, the Martin *Mars* is second to none!

Tested and Proven in Service

Most important of all, the *Mars* has been tested and proven in regular transocean service with the Navy. All "bugs" have been ironed out, all findings have been incorporated in the 20 larger *Mars* transports now being built. As a result, war's end will find Martin production lines completely tooled and manned for prompt delivery of these ultra-dependable aircraft. *Airlines and shipping companies interested in information on commercial versions of the Mars,* write: THE GLENN L. MARTIN CO., BALTIMORE 3, MARYLAND

Martin
AIRCRAFT
Builders of Dependable Aircraft Since 1909

International AIR CONFERENCE

By J. PARKER VAN ZANDT

Despite disappointments, the Chicago conference achieved agreement on many important matters affecting air travel.

As author of the recent Brookings Institution study, "Civil Aviation and Peace," and the earlier companion volume, "The Geography of World Air Transport," Dr. J. Parker Van Zandt is particularly well qualified to assess the accomplishments of the Chicago International air conference.

THE International Civil Aviation Conference just concluded in Chicago fell short of the expectations of some optimists but it has solid accomplishments to its credit. A permanent convention of international civil aviation was agreed to; an interim agreement is in force, and certain general principles were unanimously approved by the delegates. Each country adhering to the agreement grants other contracting states the right to fly on designated routes across its territory without landing, plus the privilege of landing at designated airports for non-traffic purposes. In addition, each country in the agreement will grant other countries adhering to it reciprocity in the right to carry passengers, mail and cargo to and from its homeland.

When future historians point to the conference as having laid the cornerstone for international aviation, they must give special credit to Adolph A. Berle, Jr., and to Mayor Fiorello F. LaGuardia of New York City. But for the capable leadership of the former during the 37 grueling days of the conference and the inspired intervention of the latter on at least three occasions, the forces of reaction might well have succeeded in prolonging the incredibly restrictive pre-war system or in imposing a new but equally unhappy regime of arbitrary and uneconomic controls and restraints.

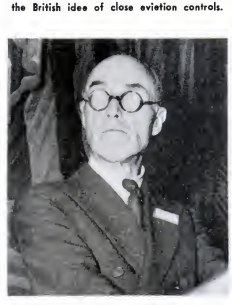
In thus naming Mr. Berle and his longtime friend, Mayor LaGuardia, for special praise, there is no intention to disparage the splendid contributions of a host of

Representatives of 51 nations rise to sing the Star Spangled Banner during the opening session of the Civil Aviation Conference.

DELEGATES REPRESENT OPPOSING VIEWS

Adolph A. Berle, the conference president, represented the American "freedom" concept.

C. D. Howe, Canadian chairman, supported the British idea of close aviation controls.



Lord Swinton, chairman of British delegation, made a reservation on Newfoundland.

others in a score or more of delegations: particularly the Latin American delegates who almost invariably backed up Mr. Berle to a man; the Chinese delegation; the Netherlands, Swedish, and Danish representatives, and others. But in the tense drama that unfolded during the exhausting weeks at the Stevens Hotel, and in spite of disunity in his own delegation, it was Berle's generalship—backed up by LaGuardia's magnificent support at the critical moments—that carried the conference through several crises and resulted in an ultimate victory for the forces of liberalism throughout the world.

To evaluate the results, it is important to understand that two fundamentally conflicting points of view were strongly represented at the conference. One group, of which the United Kingdom delegation was the spearhead, viewed civil aviation with distrust. Its attitude was basically defensive. It feared the changes which an energetic development of air transport might introduce into the world—a world whose rapidly changing character already filled them with foreboding.

The opposing group, led by the United States delegation, viewed civil aviation hopefully. Its attitude was basically optimistic. To it, the rapid development of aviation, subject to a minimum of regulations, offered the best way to promote the essential conditions of peace. It saw in world air transport an opportunity to create better understanding and unify the peoples of the globe; a means of increasing employment and developing world trade.

In its view, the arbitrary restrictions proposed by the United Kingdom and Canada not only were harmful from the point of view of world security but were undesirable obstacles to fuller employment and an expanding world economy. Between these two basically opposed positions no real compromise was possible. You can't slam on the brakes and step on the gas at the same time.

The American delegation, however, in spite of the mounting impatience of the Latin American and other delegations, made a prodigious effort to try to meet the British and Canadian desires. It indicated a willingness to accept what in effect was a severely restrictive control of rates. It agreed to 50-50 starting quotas for traffic, although the great majority of traffic on routes originating or terminating in the United States was certain to be American. It accepted in principle a complicated "escalator" formula intended to govern subsequent increases in service —a formula which was sure to prove restrictive in practice whatever its intent and an aggravation to enterprising operators of whatever nationality.

The United States was, in short, regretfully prepared to accept restrictions on post-war international air transport within almost any reasonable limit if that would resolve the difficulties. Fortunately for aviation and the world, even these major concessions were insufficient to establish a common meeting ground with the United Kingdom. An alternative plan introduced during the last days of November by the Canadians, which while essentially restrictive was not quite so hopelessly oppressive, also proved unacceptable to the British. Whether, as Mayor LaGuardia put it, it was "because of acquired instructions or inherited stubbornness," the United Kingdom would concede virtually nothing. Apparently it would approve no order in the air more vital than "the order of a well-kept cemetery."

Recognizing at last the hopelessness of continued appeasement, the United States delegation abandoned all further effort at elaboration of complicated statistical formulas along British-Canadian lines and submitted to the conference a simple, straightforward plan which came to be known as "The Five Freedoms Document." It was later adopted, substantially unchanged, as the International Air Transport Agreement, Appendix IV to the Final Act.

At the closing session of the conference, December 7, 1944, 16 nations signed this agreement, including China, Sweden, Denmark, and most of the Latin American republics; while a considerable number of other countries indicated their intention to sign promptly through the medium of their duly authorized representatives in Washington. Among these nations only Turkey elected to withdraw itself from any rights and obligations to the so-called Fifth Freedom under the agreement; that is, the carriage of intermediate traffic between states when the aircraft belongs to neither nationality.

Thus, by acceptance of this document, a great bloc of relatively free air was established in the American continents, Europe and Asia. Each contracting state within this bloc grants to the other contracting states the right to fly on designated routes across its territory without landing and the privilege to land at designated airports for non-traffic purposes. These are the so-called political privileges, or Freedoms 1 and 2. In addition, these states also exchange the so-called economic privileges on a reciprocal and nondiscriminatory basis; that is, the right to carry passengers, mail, and cargo to and from the homeland (Freedoms 3 and 4), as well as between intermediate states along the route.

If a state, as in the case of Turkey, does not care to exercise this last-named privilege, it may elect to withdraw from both its Fifth Freedom rights and obligations. The reason this option was introduced into the Five Freedoms Agreement was to permit smaller countries to protect their local international services against competition from major through services if they believed or found that such through service was interfering unduly with their regional airline traffic. In the discussion of the various statistical formulas proposed by the United Kingdom, Canada and others, this so-called Fifth Freedom had been the center of much of the controversy.

A second companion document finally adopted by the conference as Appendix III to the Final Act was the International Air Services Transit Agreement, known as the "Two Freedoms Document." It provided for multilateral exchange of the first two freedoms—the privilege of flying along designated routes across the territory of contracting states, and of landing for non-traffic purposes at designated air-

(Continued on page 150)

BATTLE OF THE Philippines

Perspective map shows battle area and routes of the opposing fleets in the Battle of the Philippines.

By Brig. Gen. HENRY J. REILLY, O.R.C.

Aviation enabled us to reach the Philippines sooner, and severely damage the Jap fleet after we got there.

NEARLY three years after our disgraceful defeat at Pearl Harbor by the Japanese, we have won in Philippines waters our first great victory of the war with Japan. In so doing we defeated Japanese land- and sea-based aviation and turned away three Japanese fleets seeking to disrupt our invasion of Leyte. And as a result of this victory we have secured a land base 5,300 miles west of Hawaii and only 1,400 miles from Japan.

This enormous advance of our forces in the Pacific entailed the rebuilding of our fleet, the development of an entirely new solution to our Naval supply problem, the fashioning of daring strategy and the development of brilliant new aviation tactics.

Our aviation has attained superiority over the enemy's aviation, it has provided invaluable information about the movements and activities of the enemy, it has proved a striking force of great power against the enemy's fleet, his land targets and his troops in the field. Our aviation has obviated the necessity of island-hopping and has permitted us to by-pass and neutralize enemy strongpoints. Without aviation, the success of our unorthodox strategy and the speed of our advance would not have been possible.

It took more than two years after Pearl Harbor before our fleet, with its air force, was strong enough really to take the offensive. After that disaster we had to rush what little fleet and Naval air we had in the Pacific to the Pacific Coast or Australia so that it might be safe from

possible attack by the overwhelmingly superior Japanese fleet with its air force.

The next step was to make the maximum use of American industry to build up our aviation, to repair the damage to our battleship force at Pearl Harbor, and to replace the 13 new capital ships destroyed as a result of the Washington Arms Conference. At the time Japan attacked we had 15 battleships, seven in the Atlantic and eight in Pearl Harbor. Of these eight, two were sunk and the rest were badly damaged.

As a result of the Washington Arms Conference we destroyed nine battleships carrying nine 16-inch guns each, and six battle cruisers carrying eight 16-inch guns each. These ships alone could have sunk the whole Japanese fleet had they been in existence at the time of Pearl Harbor.

Thanks to the new ships we have been building, we now have 23 battleships and two battle cruisers in condition. We have more than 100 aircraft carriers of all types, most of them new since Pearl Harbor. We are reported to have 16 battleships and most of our carriers in the Pacific.

We have also developed entirely new methods of supplying a fleet. In the past, and in all navies today except our own, ships have had to return to naval bases on land from time to time and particularly after battles, for supplies and fuel. They could not keep at sea for a long period much less fight new battles.

But now this problem has disappeared. We are not only able to keep our surface ships at sea for long periods always ready to fight but also keep our Navy aviation at sea with them—equally ready to fight.

This tremendous advance in Naval warfare has been accomplished by organization of a Pacific Fleet Service Force. This force carries from the mainland base to the fleet the ammunition, food, gasoline, oil, supplies of all kinds, and the means of making all but major repairs on both ships and airplanes.

After making the remnants of our Pacific fleet safe after Pearl Harbor, our next problem was to keep open a line of sea and air communications with Australia. The Japanese, after seizing the Dutch East Indies, began moving eastward from them and southeast from the Marshall Islands. The Japanese seized islands, including the Gilberts and Solomons, in order to cut our line. If not stopped they would have gone on to the Fijis and New Hebrides. Our first job, after receiving fleet and air reinforcements, was to stop this Japanese advance.

We did stop it and gradually built up MacArthur's ground and aviation forces, enabling him and the Australians to pass from the defensive in Australia to the offensive in New Guinea and the Japanese-held islands immediately north. By the end of 1943, two years after Pearl Harbor, we were finally ready to start a two-pronged concentric offensive which would take us back to the Philippines.

←

Part of our air strategy was to keep Japs off balance by attacking their supporting bases. Here is a record of Superfortress damage on Formosa in raid of October 14.

The Japanese were aiming at such a task force as this. Nearly 70 ships, including cargo vessels, cruisers, destroyers and carriers can be counted here. The latter include eight escort and two Essex-class carriers. White vessel in foreground is hospital ship.

By means of triphibious operations MacArthur was to advance northwestward to the Philippines. Our main fleet was to advance from Hawaii approximately west to the Philippines.

Had each of these forces settled down to a campaign to capture the nearest islands from the Japanese, and then the next and so on, we probably would not be half way to the Philippines now.

But by recognizing the power of aviation if continually supplied, and making a correct estimate of Japanese ignorance of our strategy, both Admiral Nimitz and General MacArthur embarked on a bold strategic policy. It was one never carried out before—a policy of attacking and capturing only essential islands to protect the rear and flanks of their advance and simply by-passing the rest of the Japanese garrisons of ground forces and land-based aviation.

Despite the revolutionary power of aviation, this would not have been possible had the Navy not created the Pacific Fleet Service Force which enables our battleships and carriers to keep to the sea for long periods of time without returning to their main bases in Hawaii or Australia.

There is little doubt that the Japanese concept of the strategical situation failed to take into account the rapidity with which American industry could build up a relatively small naval aviation force and a half-destroyed battleship fleet into a combined battleship force and Navy air force greatly superior to anything their navy and its air force could put into action.

(Continued on page 90)

The proof of air power. A fleeing Japanese ship leaves a wake shaped like a question mark in vainly dodging air attack by U. S. planes in the Battle of the Philippines described in this article. The wakes of other Japanese ships can also be seen in photo

YOU WILL FLY The

By
GAITHER LITTRELL
Western Editor of FLYING

FLIGHTS into the stratosphere six miles up by crews of our high-flying *Superfortresses* are commonplace today and commercial airline executives are preparing now for the post-war period when their planes and passengers will soar into this storm-free zone on long flights, with the passenger as comfortable as though he were in the living room of his home.

No commercial airliners are yet flying on regularly scheduled runs anywhere near the 30,000-foot strata. But they will, thanks to a newly-perfected airplane installation known as a pressurized cabin.

Such cabins in the sky today are installed in only three of the larger planes known to the public—the Boeing *Superfortress* and the newly announced *Stratocruiser* and the Lockheed *Constellation*—but they are standard equipment on at least two other planes still restricted by military security.

Pressurized cabins are reinforced cylindrical structures built within the plane's fuselage. In these the pilots and crew members of our bombers—and passengers in future air travel—fly at extreme altitudes without the aid of oxygen masks and special breathing equipment. The outside rarefied air is warmed and pressed into these cabins, giving the airmen enough oxygen from this source to fly on indefinitely.

But why pressurized cabins?

Principal advantages are that anoxia (lack of oxygen) and aeroembolism (aviator's bends) are prevented.

Until advent of the pressurized cabin, special oxygen breathing equipment had to be used for high altitude flying. The *Superfortresses* today are adequate to 40,000 feet.

The problem of the "bends" or aeroembolism is solved with pressurization because the nitrogen which is dissolved in the blood remains in solution instead of being released in bubbles that flow through the blood stream and may lodge in a vein, blocking the blood vessel and causing extreme pain. This can happen where there is no pressurization.

Most important part of the pressurization system is the pressure regulator, originally designed by Boeing Aircraft Company and perfected and built under license today by AiResearch Manufacturing Company, Los Angeles.

Almost invulnerable to failure, the AiResearch unit is capable of maintaining an inside pressure of 6.5 pounds per square inch, or the equivalent of an altitude of 10,000 feet, while the plane is cruising at 35,000 feet where the outside pressure is only 3.5 pounds per square inch. When the plane is at 40,000 feet, inside pressure is equivalent to 12,000 feet, under 7.5 pounds per square inch pressure.

It has taken a long time to develop pressurization to that standard. . . .

For more than 10 years several of our top research and development concerns have worked with airplane manufacturers, under the supervision of the Army Air Forces Air Technical Service Command, to perfect it.

The problem was two-fold: How to enable both human beings and gasoline engines to operate in the rarefied air of extreme heights.

The engine problem was solved with the development of the supercharger, which pumps and compresses the thin upper air into the engine to obtain enough oxygen for proper combustion.

It was found that man could go to about 18,000 feet and stay there a brief few minutes without oxygen. With oxygen equipment he could go much higher, but his supply of oxygen limited such flights to approximately six hours. Pure oxygen will not always keep man alive at those altitudes because pressure is so low that insufficient oxygen is forced through the membrane between the air sacs of the lungs and the blood stream.

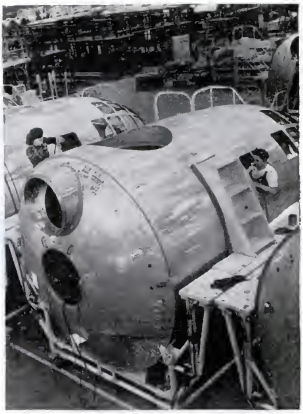
Back in 1919, Army Air Corps engineers began constructing pressure equipment in an old DeHavilland observation plane, but the cabin leaked badly and the project was dropped.

Interest in pressurization lagged until 1934, when aeromedical experts of the Air Technical Service Command directed the building of a decompression chamber to study the effects of high altitude on man. They found it was not only a simple problem of supplying oxygen in thin air levels but also one of pressure.

A pressurized suit was the first attempt at solution. The suit actually was a diver's helmet and overalls made as leakproof as possible, into which air was pumped. This didn't work.

High Road

Pressurized cabins, now used for six-mile-high bombing missions, promise passenger comfort along aviation's most economic highway.



Cylindrical fuselage and rounded bulkheads of Superfortress units are designed to retain constant cabin pressure.

Shortly after, two Air Corps officers went up to 72,935 feet in a special balloon gondola, thus setting a world's altitude record. Their flight drove home the fact that a sphere offered the ideal pressurization shape because it equalized pressure on the entire structure. Experiments then were begun to place cylindrically-shaped pressure chambers within aircraft frames.

In 1937 came the first successful pressurized airframe. It was that of the XC-35, a transport developed by Lockheed Aircraft Corporation. The pressurized cabin worked to a degree but at high altitudes the windows coated up solid with ice on the outside and clouded with fog and moisture from within. Fans blowing warm air against the panes partially corrected this fault but then came the job of sealing the structure against leakage.

Thin rubber cement was poured in doors and joints. This enabled an altitude of 20,000 feet to be reached while the interior pressure equalled that of sea level. The Army pilots flew the plane over a marked course of 220 miles at a speed of 350 m.p.h. while later, on a flight from Chicago to Washington, it averaged 368 m.p.h.

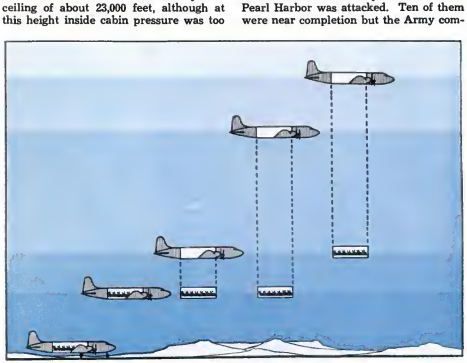
A year later the Boeing company began construction of the 307, or what was later to become known as the *Stratoliner*. The company claimed it to be the first plane in the world pressurized for the comfort of airline passengers.

From previous Army tests, Boeing knew that the shape they wanted was a sphere. There are no bending stresses in a sphere, all material in it works in tension and a minimum amount of material is required.

Their next problem was to prevent excessive leakage of air from the cabin. Skin seams had to be both riveted and sealed with sealing compound. A tape impregnated with a sealing compound was selected for insertion in the joints before riveting. Sealing of control cable openings was accomplished in installation of a synthetic rubber bushing at the points through which the cable passed.

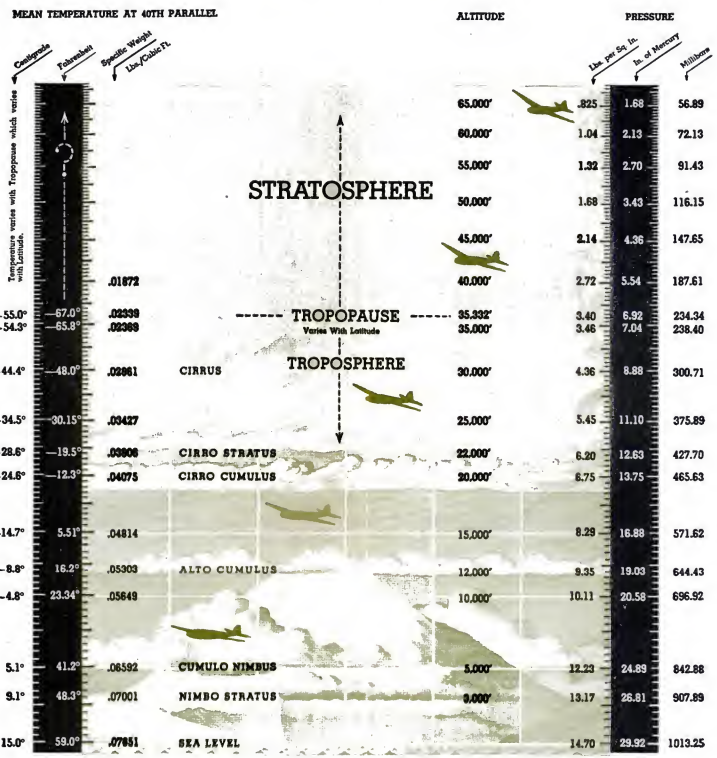
The *Stratoliners* flew successfully at a ceiling of about 23,000 feet, although at this height inside cabin pressure was too low to provide full physical comfort and efficiency. However, the plane was decidedly closer to what engineers were seeking.

In 1940, Douglas Aircraft Company had developed the present-day *Skymaster* and started line production on the model the first of 1941. This plane had been designed with a pressurized cabin. Twenty-four of them were in production when Pearl Harbor was attacked. Ten of them were near completion but the Army com-



Pressurization units now in use maintain constant 8,000-foot cabin pressure up to 30,000-foot altitude. At 40,000 feet—limit of unit's utility—pressure approximates 12,000 feet.

ATMOSPHERE CHART



Graphic study of aerial highways. this chart shows ratio of decreasing temperature and pressure at altitudes up to 65,000 feet.

mandeered them and ordered pressurized cabins removed. Since that time, all pressurization on *Skymasters* has been eliminated.

At about the start of the United States' participation in the war, North American Aviation designed the XB-28 [see page 51], in which engineers supercharged the cabin to a pressure equal to 8,000 feet when the plane was at an actual altitude of 30,000 feet. This project was dropped, however, when the Army decided against contracting for the XB-28's.

A short time before the XB-28 model, Boeing was preparing new designs for their Model 345, which was to become the B-29.

These *Superforts* are built in five sections—nose, bomb bays, waist, after and tail sections. The nose, waist and tail sections were to carry crewmen in flight. Therefore they were to be pressurized.

The problem of transferring crew members from the pressurized nose section through the unpressurized bomb bays to the pressurized waist section was solved by installing a cylindrical tunnel through the bomb bays to connect the nose and waist. The tunnel is large enough for a man to crawl through. A non-pressurized after section separates the tail gunner in his pressurized area from the waist section. There is no need, naturally, to supercharge the two bomb bays.

In *Superfortresses*, airmen reach their target in top physical and mental condition. Without pressurization the big bombers would have to fly low, making

(Continued on page 138)

Who Controls the Air?

Former CAA legal counsel believes that Federal-states controversy on air regulations has been substantially solved by recent court decisions.

By WEBB SHADLE

Recently resigned as general counsel, office of the Administrator of Civil Aeronautics, to enter private law practice, Mr. Shadle is a World War I naval aviator, a graduate of the Columbia University Law School, and has had 12 years' practice in the field of administrative law. He desires to acknowledge the assistance of Glen D. Woodmansee, newly-appointed acting general counsel, and Douglas D. Crystal, senior attorney in the CAA aeronautical legal office, in the preparation of this article.

FROM a legal viewpoint, the problem of Federal-state aviation relations may be well on its way to solution. The case of the United States of America vs. Andrew D. Drumm, Jr., mentioned in last month's FLYING, has far-reaching importance and its significance has not been fully considered by the air-minded citizens of our nation.

The complaint of the United States of America filed against Mr. Drumm contained statements that he flew from Fallon, Nev., to Bishop, Calif., on February 11, 1942, and from Bishop to Independence, Calif., on February 15, 1942.

Flights over these courses were common in those days and caused no Civil Aeronautics inspector to lift an eyebrow. But the utter disregard of Mr. Drumm for some of the every day conventionalities universally observed by pilots, plus the epithets hurled by him in the faces of the law enforcement officers and Civil Aeronautics inspectors at Bishop made these flights epochs in aviation history.

Specifically, the complaint charged that Mr. Drumm had (1) no clearance at the Fallon airport, (2) no pilot certificate of competency, (3) no identification card, (4) no aircraft operation record attached to the airworthiness certificate, (5) no airworthiness certificate in the airplane, and, on the flight from Bishop to Independence, (6) no clearance at the Bishop airport. In addition, he was charged with No's. 2, 3, 4 and 5 on the flight from Bishop to Independence.

According to the complaint, Mr. Drumm repeatedly, openly and publicly flaunted and ridiculed the authority of the Civil Aeronautics Administration; tore a suspension notice from his airplane; repeatedly and publicly boasted and declared that he habitually operated aircraft without a pilot's license; that the Civil Aeronautics Administration had no jurisdiction or authority over him; that the representatives of the Civil Aeronautics Administration were a bunch of "boy scouts" and were trying to "Hitlerize" the aviation industry.

Affidavits filed with the court revealed that it was necessary for a deputy sheriff to drive his motor vehicle in front of Mr. Drumm's airplane to prevent a take-off from the Bishop airport, and that the deputy sheriff finally drew his revolver to convince Mr. Drumm that the enforcement officers would not tolerate disobedience of the law.

Upon the complaint of the Government and affidavits of witnesses, the Court issued a temporary injunction prohibiting Mr. Drumm from operating aircraft and an order to the United States Marshal to seize the airplane. Subsequently, on deposit of bond, the airplane was released.

The basic authority in support of the decision of Judge Norcross is contained in the Constitution of the United States of America. It is the so-called "commerce clause."

From the discussions and the emphasis placed upon it, many persons have the idea that the commerce clause is a long, complicated body of fundamental law. On the contrary it is most brief. Turn to Section 8 of Article I of the Constitution of the United States of America:

[*Congress shall have power*] "*to regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes;*"

Should there be any doubt as to the depth of the thrust and wide applicability of the commerce clause, an examination only needs to be made of the case of the United States v Wrightwood Dairy Co. 315 U. S. 110 (1941).

The Wrightwood Dairy Company, a domestic corporation of Illinois, sold milk products produced solely in Illinois for consumption solely in Illinois. The Secretary of Agriculture considered the price at which such milk was sold in Illinois too low and ordered it raised. This action was taken pursuant to an act of the Congress which permitted the Secretary of Agriculture to handle all products which "directly affects" interstate commerce.

Mr. Chief Justice Stone, who delivered the opinion, stated that the commerce clause extends to those activities wholly within the state which so affect interstate commerce, or the exertion of the power of Congress over it, as to make regulation of them appropriate means to the attainment of a legitimate end—the effective execution of the granted power to regulate interstate commerce.

Using this decision as a guide, many concerns engaged in business wholly within a state could very well be considered to fall under the "commerce clause" *if the product manufactured or distributed directly affects interstate commerce.*

Back in 1912 the nation's Supreme Court considered some railroad rate cases from the State of Minnesota. The decision is entitled "The Minnesota Rate Case" and covers about 120 pages. The opinion was written by Mr. Justice Hughes and, it is a genuine pleasure to state, was unanimous.

The question in these cases had to do with the power of the State of Minnesota to establish freight and passenger railroad rates. Although the court followed the many precedents contained in earlier decisions, it elaborately discussed the relative powers of the Federal Government and the states with respect to interstate commerce.

The three spheres of action defined in this opinion are still considered to be the law of the land. With these spheres in mind it will be relatively simple to apply the "commerce clause" to the facts in the aviation cases which follow.

(*Continued on page 104*)

Before I Buy a

An ardent partisan of private flying scores traditionalism in re-examining our conventional personal planes and our discouraging aviation regulations.

By

JOHN H. GEISSE

John Harlin Geisse learned to fly as an Army Air Corps pilot at Rantoul Field, Ill., in 1917, and has been active in aviation ever since. Currently a consulting engineer with the Civil Aeronautics Administration, he has been chief engineer at the Naval Aircraft Factory, an experimental engineer with Wright Aeronautical Corp., and has held other industrial jobs. He is known to pilots as a student of and spokesman for private flying.

MILLIONS of Americans want to fly and it is important to our national well-being that they do so. But whether they will depends on how well we manage our economy, how successful the airplane manufacturers are in building the kind of airplanes the public wants, the number and accessibility of airports for the personal airplane, whether airport personnel provide satisfactory service, and whether the Government discontinues its pre-war regulatory policies.

Surveys by Dr. F. L. Whan of Kansas and by *Collier's* indicate that over a million persons not only wish to fly but expect to be able to do so in their own airplanes. Both surveys indicate a potential immediate post-war market for 200,000 airplanes.

Some in the industry believe that high taxes in the post-war period will hinder personal flying. Others would prove, on the basis of spending habits of families, that only a few will be able to afford a personal airplane.

I am not an economist—I cannot tell you how we can pay higher taxes and at the same time buy more personal airplanes. But I am an engineer, and I know that our production capacity has been tremendously increased during the war. Simple arithmetic tells me that our consumption must be correspondingly increased if we are to use this production capacity.

We must double our pre-war consumption to keep men fully employed. If all of us purchased personal airplanes, we would still have to increase our purchases of other things even while paying high post-war taxes to meet such a goal. These economic "musts" do not appear to substantiate statements that reduced purchasing power will prevent an expansion of personal flying after the war.

Personal airplane enterprise, however, is the sort of cake we cannot eat unless we bake it. If the aviation industry individually and collectively participates in (or is indifferent to) restrictions of output simply because they temporarily increase the industry's share of the cake, we will all end up with no cake to divide. This is what was meant by the statement that our post-war market for personal airplanes will depend upon how well we manage our economy.

Consider the personal airplane itself. Its pre-war sales were not limited by the number who could afford it. Sales were limited only by the number who believed that private flying was worth its cost. Of those who entertained such a belief and took out student permits, only 15 per cent retained that belief and went on to get pilot certificates. Of those brave souls who finally purchased a personal airplane, one-third became disillusioned within a year and another one-fifth in two years. It's easy to see the effect these dissatisfied aircraft customers must have had in influencing others not to try personal flying.

As early as 1929 airplanes could have been constructed which would have been safe and easy to fly. But airplane manufacturers were saying: "You cannot teach people to fly in an airplane which flies itself." To this double talk they added the pugnacious assertion: "If the public is not interested in learning how to fly our present airplanes then we don't want them in the air." And the attitude that

An example of practical roadability, this Pitcairn two-place autogiro has rotors which fold back parallel with fuselage.

The Stearman-Hammond was a practical "foolproof" plane with non-spinning characteristics. Its cost was main obstacle.

Not a freak but the author's serious proposal for a high-performance lightplane, this design represents a modification of the Crouch-Bolas theory discussed in the article. The 10 small propellers will increase the velocity of all air over the entire wing and also control the boundary layer. This will greatly increase the maximum lift and retard stall. In addition, this plane would have reverse tricycle landing gear, with both front wheels steerable and the rear wheel castering. The wings would fold up alongside the twin booms so that plane would be roadable.

the airplane should be designed for pilots, not for the public, has persisted down to the present time.

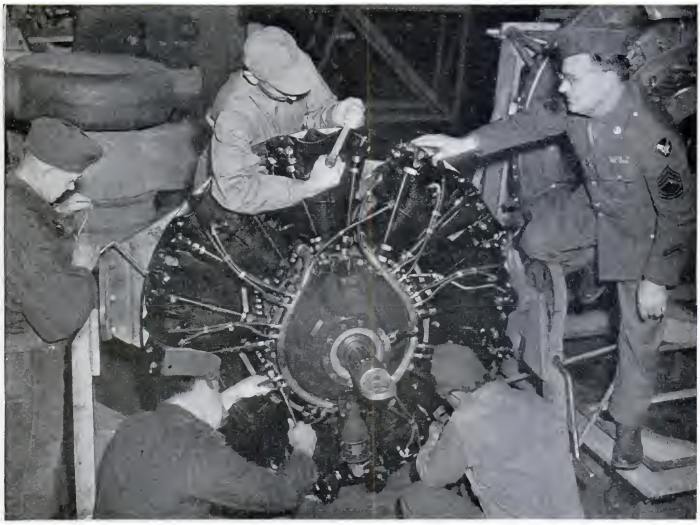
One result of such warped reasoning is that we have stressed speed above all other factors. Some manufacturers actually believe that speed is all the aviation industry has to sell. They have it to sell, but the number of customers for speed is not sufficient to keep their plants going. Of dissatisfied pre-war customers, 28 per cent believed that too much attention had been paid to high speed and too little to low speed as against 11 per cent who held the opposite view. Those who have not considered flying at all probably hold still more pronounced views on this subject.

To achieve high speeds we sacrificed the ability to get into and out of small fields. The result was that we placed a limitation on the number of airports which could be supported, philanthropically or otherwise. We moved them all farther from centers of population than necessary. Dissatisfied customers, both owners and students, gave inaccessibility of airports as the major reason for abandoning personal flying.

Very little effort has been made toward securing quiet operation. Yet quietness of operation would materially increase the pleasure of personal flying and would make possible an airport accessi-

(Continued on page 98)

There doesn't seem to be much modern about this Curtiss racing biplane in Machinery Hall, San Francisco, in 1915—but it had a tricycle landing gear which lightplanes need today.



Motor overhaul—a "work-cure" activity that steadies war-frayed nerves, prepares patients for new duties on battle or home fronts.

CURING the 'FOCKE-WULF

By NANCY H. MacLENNAN

Staff writer, New York Times

Airmen find classes in navigation a happy relief from twiddle-your-thumb hospitalization.

INSTEAD of the traditional "rest cure," combat-weary U.S. airmen returned from war are now getting a "work cure." Hospitals once filled with long rows of beds occupied by inert and bored patients now hum with activity. Even the bedridden work. Doctors and patients alike testify that the work cure is one of the war's outstanding successes and shows excellent promise of revolutionizing many of our peacetime hospital methods.

The work cure is especially valuable in treating operational fatigue, unofficially known as "the Focke-Wulf jitters." Operational fatigue is the occupational disease of the combat flyer. In the words of Maj. Gen. David N. W. Grant, Air Surgeon of the AAF, "it does not differ fundamentally from the nervous breakdown of an overworked clerk who has a tyrannical boss or nagging wife." But there are differences.

"Each man has his flying efficiency curve and even the best will reach a point in that curve where he will break

down himself or crack up his plane. Operational fatigue is an illness made of emotional and fatigue symptoms generally manifesting itself in a state of anxiety." It is not a true neurosis, but a reaction of normal people—otherwise sound pilots or crewmen—to abnormal situations. A psychoneurotic case is actually the reverse—an abnormal person reacting to a normal situation.

With U. S. airmen involved in the worst conflict of world history, it would seem to follow that cases of operational fatigue would be numerous and on the increase, but preventive measures have kept the number of cases to a minimum. Courageous work on the part of all concerned is further reducing that minimum as this is written.

Chief of the preventive measures was the program for scientific selection of aviation cadets established soon after the United States entered the war. In the past two years nearly 500,000 aviation cadet candidates have been put through what General Grant characterizes as "the most comprehensive mass psychological test program in history." This selection of men with special aptitude for flying, combined with the physical exam that accompanied it, eliminated more than 80 of every 100 candidates.

Operational fatigue knows no boundaries, favors no theater of war. It occurs more frequently among bomber crewmen than among fighter pilots because bomber pilot and crew must suppress individual impulses, stick at their stations and hold their plane in position, while the fighter pilot has comparative freedom of action. Bomber pilots and crewmen have been known to complain that they never get an opportunity to *fight!*

Operational fatigue shows most frequently during the first five missions—some airmen have "a low threshold of endurance." Another difficult period comes about two-thirds of the way through an operational tour when the accumulated effects of repeated stress may begin to tell and the flyer starts worrying about his luck running out before he gets leave.

Here's where the ounce of prevention has proven highly effective. Flight surgeons, noting fatigue signs, will pull a man off duty and send him to a rest camp away from combat for a week or so. Usually he comes back and successfully finishes his tour. The move is really a double safeguard. It saves the individual airman from a bad case of operational fatigue and it protects his fellow crewmen. Men suffering from operational fatigue often weaken the morale of other airmen and may even endanger

(*Continued on page 122*)

Modelling is a therapeutic pastime that helps to keep flyers familiar with aerodynamics.

JITTERS'

A "work-cure" program devised to speed the recovery of wounded or combat-weary AAF airmen promises to revolutionize post-war methods of hospitalization.

Bedside Gremlins forgotten, these wounded airmen have plugged into a course in radio.

The THUNDERBOLT

By ROLAND C. GASK

Big and rugged, the Thunderbolt is a unique answer to attempts to build a high altitude fighter.

ONE day in June, 1940, a dozen or so top-ranking Army Air Forces officers and aviation engineers were talking excitedly together at the Army's Wright Field, Dayton, O. France had just fallen. For the first time, the full significance of military air power had been brought home to the United States. And in the big smoke-filled conference room the khaki-clad air chief and the engineers were tussling with an urgent problem: how to get going quickly on the design and mass production of a mighty new American fighter that must be able to knock any rival out of the sky.

The Battle of France had revolutionized the experts' ideas. The word being mostly batted about was "more"—the Army wanted more speed, more firepower, more ammunition capacity, more altitude, more range, and more armor, not to mention many other improvements such as bullet-proof glass and self-sealing tanks. One by one, the conferees' ideas tumbled out—a somewhat hazy inconglomerate mass sufficient to turn any plane designer gray.

While the bigwigs were talking, a broad-shouldered dark-complexioned little man with a sad expression, soulful Slavic eyes and a reticent far-away manner was quietly sitting in the background, sketching on the back of an envelope. Toward the end of the conference he showed his drawing to one of the generals who was present. The plane roughly depicted on the

(*Continued on page 134*)

The Lancer, real prototype of the Thunderbolt, was comparatively underpowered.

The XP-47B was announced by the War Department in 1941, entered combat in 1943.

Latest version of the Thunderbolt, the P-47D has a bubble canopy and a top speed of approximately 450 m.p.h.

The facing full-color cutaway drawing of the P-47D — the latest Thunderbolt — illustrates construction details and location of components.

WHY YOU GET *Airsick*

Airsickness is a form of motion sickness which is almost always influenced by psychological factors. Hence, it usually is curable.

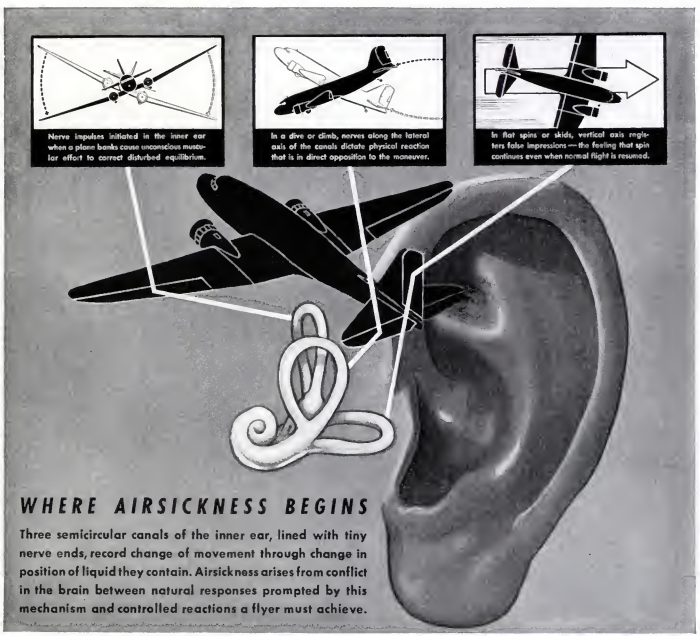
By ANDRE BERNIERE

AIRSICKNESS need not worry post-war travelers any more than carsickness now concerns millions of American motorists. That fact has been established by the two biggest airlines in the world—the U. S. Army Air Forces and the U. S. Navy.

In staging a military air operation, every move must click with clock-like precision. An airsick pilot, navigator, bombardier, gunner or airsick paratroopers—these, in a military sense, are casualties. They represent a waste of military efficiency that could cost an aircraft carrier or upset an invasion timetable with disastrous results.

Airsickness on U. S. commercial airliners, contrariwise, is not as serious or as widespread as most people imagine. Since the advent of modern airliners it has always been less than one per cent of passengers carried and one major airline reports that for the six years from 1938 to 1943 inclusive only 1.9 per 1,000 passengers were airsick. Lately that figure has been rising. That same airline reports that in September, 1944, 342 out of 60,513 passengers transported were airsick—a rate of 5.6 per 1,000 passengers.

Dr. A. D. Tuttle, medical director of United Air Lines, is inclined to believe



The messages sent to the brain by the inner ear provide the physical basis for airsickness but psychological factors are important.

These are reasons students say they get airsick. While motion sickness is basic, this chart illustrates the psychological influences. A general answer is "association"—meaning anything associated with a previous airsickness.

that the wartime rise in airsickness rates is due to the lower physical resistance of many passengers, particularly veterans from various war theaters who are recovering from wounds, illness or combat fatigue.

The incidence of airsickness among private, student, and military pilots, of course, is much higher than among airline passengers. Their plane platform is less stable than the airliners, they engage in more acrobatics and fly under tenser conditions, all contributing factors to airsickness.

Perhaps the simplest definition of airsickness is that it is a form of motion sickness. Movement of the plane while in flight is a basic cause of the illness. If the wings were removed and the plane used as an automobile, the illness produced by the motion would be labeled carsickness. Used as a boat, it would produce seasickness. In each instance, it is motion—swaying, bumping, long and slow up-and-down motion, continuous and long-winding turns—that produces the illness.

But motion alone is not the only cause of airsickness.

Studies by Army and Navy air surgeons have shown that there are two basic causes—motion and emotion. They have even found that symptoms of airsickness can be produced by emotional reactions alone—by "apprehension" or "fear of flying." This has been demonstrated by the individual who experiences symptoms while sitting in a plane waiting to be taxied out to the take-off point, or by the individual who shows pallor and sweating and is nauseated by merely contemplating a flight. In these instances, motion plays no part in producing the illness, yet the effect cannot be distinguished symptomatically from airsickness. A recent edition of the United States Naval Medical Bulletin said "it has been the contention of the instructors that a great proportion of all cases of airsickness are due to fear or nervousness, their figures ranging from 70 to 98 per cent."

At one Naval station, a group of airsick trainees was asked to list the factors having as their basic causes fear or nervousness. They gave these factors, in the order of the greatest number of causes:

No stunt interval, fumes, lack of previous training in stunts, fear or nervousness, not mentally occupied, interruptions in training, eyes fixed inside cockpit, flying with instructor, loose safety belt, eyes not fixed on distant object, association, sandbagging and poor instruction.

Among other factors which also might be caused by fear or nervousness they listed insufficient rest, poor physical condition, uncomfortable clothing, rough weather, position in plane, position of seat and vomitous fumes.

"Thus," the Bulletin said, "the trainee agrees that approximately 75 to 80 per cent of his trouble is due to these basic factors. The remaining 20 per cent may be classified under faulty eating or drinking habits, warm weather, excessive smoking and alcoholic excess. . . .

"Increase in airsickness was noted during the summer. Undoubtedly the flyer is more uncomfortable at this time."

As part of the program for combatting such airsickness, the flight surgeon at one Naval station explained to trainees how and why nervousness or fear can cause this condition. He showed them that there were only a few men who were unable to treat and cure themselves of airsickness. This was supplemented by a talk with the instructor on how to aid trainee pilots under his care.

A variety of motions cause airsickness, especially the very long movements. These are not confined to travel in a plane. For example, the big swells of the ocean where the motions are long and slow most frequently produce seasickness, whereas the motion of a rowboat on a small inland lake with choppy waves seldom does. Similarly, a person riding horseback doesn't get motion sick; put him on a camel and chances are he will.

A dancer whirling around also gets dizzy—even ill—if she doesn't snap her head around with each turn in a sudden quick movement and "unwind" herself by spinning around in the opposite direction.

Motions of an airplane in flight which produce airsickness include pitching, bumping, yawing and corkscrew motions, and motions resulting from weather conditions—such as "bumpy" air caused by thermals, wind variations and "fronts." Also a plane in the rear of a large formation is likely to find the going rough and bumpy because of the propwash of the planes in front.

Purposeful motions—spins, stalls and acrobatics—and unintentional movements—those attributable to the inefficiency of the pilot, or poor functioning of the automatic pilot—further contribute to airsickness. The position of the individual with respect to a plane's "center of rotation" is highly important. A tail gunner would be more susceptible to airsickness stimulated by motion than the pilot because the gunner is farthest removed from this center of rotation—or center of gravity.

Motion means a change in position. The three chief means of perceiving that change are the muscles and joints (the sensations referred to as "flying by the seat of the pants"), the eyes and the organs of balance in the inner ear.

Chief cause of motion sickness is contained in the inner ear—the delicate mechanism that makes it possible to perceive motion of the body from side to side, up and down or backward and forward. When the balance is upset, tiny nerve fibers of the ear send messages to the brain. An excess of these messages—a jamming of the "switchboard"—agitates the nerve mechanisms of the brain which produce vomiting.

In orienting one's self in space, there is an important relationship between the inner ear and the eyes. If the cadet pilot can learn to keep his eyes out of the cockpit and fix them, instead, on some point of the earth, he will be less susceptible to airsickness—all other things being equal.

This is particularly true in doing the acrobatic maneuvers required in pilot training—spins, stalls, spirals, slow rolls, etc. The stunting stage in pilot training, and failure to keep the eyes fixed on some distant object outside the plane are high on the list of airsickness causes given by a group of 1,000 airsick Naval

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Line-up of planes at the Salisbury, Md., airport. Proper discipline requires that parked planes have wings tied, wheels chocked

AIRPORT DISCIPLINE Means Safety

By R. J. CURRY

Maintenance Section, Civil Aeronautics Administration

Adequate instruction plus properly delegated authority saves money for the private operator.

THE operator of a base I am familiar with had a model setup. He had fine facilities, good personnel, and his equipment was maintained and polished until he had a show place. He had a large volume of business and could afford the best.

But one day a training plane spun into the ground, killing the instructor, the student, and completely demolishing the plane. There were plenty of witnesses, making possible a reasonably accurate assumption of the cause of this accident.

At 1,500 feet the plane was observed to go into a spin. Apparently there was no attempt to pull out until it reached a dangerously low altitude. The spin was stopped but the speed permitted to build up excessively. On the pull-out, the plane mushed into the ground, killing both pilot and student.

This fatal accident demonstrated several instances of poor judgment—permitting a spin at this altitude, failure to effect immediate recovery, and permitting too much speed to build up. These were the obvious causes and contributing factors but the real reason these two pilots were killed can be traced back for several weeks.

First, investigation revealed that the student and instructor had been seen diving on a tavern a week or so previously. With other instructors and students, they had been engaged in mock dog fights and in attempts to play follow the leader at low altitudes. There can be little doubt that the fatal accident described here is a direct outgrowth of such horse-play.

The operator was not responsible for this crash—but by the same token other operations that had regular pilot meetings and tried to take them seriously have not had this type of accident. They have had accidents, of course, but they are the type caused by pilot technique and not horse-play and violations of common-sense rules.

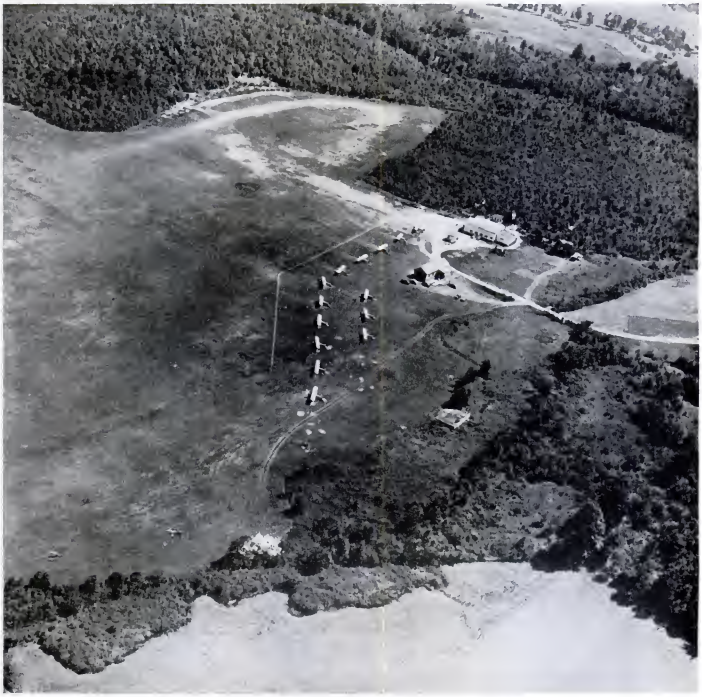
In essence, the cause of this accident was lack of discipline. A survey of a number of airport operations has shown that discipline is very low. Invariably at airports where discipline is low, accidents have occurred or property has been damaged in a manner that could have been prevented if good common sense had been used.

There are other causes of course. Oper-

(Continued on page 114)

For small communities or fixed-base operators who find initial runway-surfacing costs too high, here's some pertinent advice—

LET YOUR AIRPORT *Go to Grass*



Turfed all way field of the Bowman Flying Service at Keene, N. H., is an inexpensive answer to post-war airport surfacing problems.

By Joan David

Mat-like stem and root system of Zoysia, one of 30 grasses used fo airport turf.

Roots of this three- to five-inch Zoysia bind the earth to corresponding depths.

WHEN the average American thinks of an efficient up-to-date airport, the picture that comes to his mind is a symmetrical pattern of paved runways. But actually, less than a third of our 2,900-plus landing fields [all the major ones, however] are so designed. And when the Civil Aeronautics Administration announced its plan for 3,050 new airports to accommodate post-war flying, 2,300 of them were tentatively earmarked as turf fields, completely devoid of paving. Some of them will be allway turf fields on which landings can be made in any and all directions, while others will be T-, V- or L-shaped turf landing strips. The details, of course, depend on the funds available and on the individual communities involved.

For some, this may sound like a reversion to the converted cow-pasture which served as a landing field in the early days of aviation. But our newest turf fields, and the methods used to develop them, cannot be compared with their predecessors. Properly planned, established and maintained, they have withstood intensive use by all but the heaviest planes.

Experience with pasture-type fields which rutted badly in wet weather and whose sparse cover wore off under intensive plane traffic first turned us to paved runways. Such fields were not designed for heavy usage under all weather conditions. The intensive training programs and heavier planes quickly caused damage which necessitated continuous and expensive repairs. Paved runways seemed the only solution. Airport development in Europe, where many fine turf fields were constructed, followed an entirely different course.

A survey of the important military and civil airfields in Europe at the outbreak of the present war revealed few with paved runways. Le Bourget (where Lindbergh ended his famous flight) at Paris had 494 acres of turf; Croydon airport, London, had 300 acres of turf; fields at Copenhagen, Prague, Rome, Venice, Marseilles, Munich, Hamburg, Stuttgart, Brussels, Antwerp, Zurich, Malmo and Madrid were all allway turf fields. Most interesting of all was the enormous Tempelhof airdrome at Berlin. There a 90-foot-wide arc of paving along one edge of the field was designed for taxiing and take-offs. Landings were made on the 1,333-acre turf field. If the field had shown too much wear it was planned that runways be put in along the lanes established by actual use.

Chief arguments in favor of turf fields are economy and safety. In constructing an airport, grading and draining must be done no matter what type of surface cover is used. But at that point the expenditures are no longer parallel. Seeding and sprigging costs range from $50 to $750 an acre, sodding from $1,950 to $2,400. But a good bituminous surface costs from $4,000 to $15,000 and concrete from $9,000 to $20,000 an acre. A small T-shaped landing strip field having two strips 1,800 by 300 feet covers 24.8 acres for the strips alone. For such a field, turf cover will cost $1,240 to $18,600; a bituminous surface from $99,200 to $372,000 and concrete from $223,200 to $496,000. Transportation costs, climatic conditions, type of grass used, planting methods and topsoil and fertilizer requirements are some of the variables affecting cost of turf.

Recent informal questioning of many Army, Navy and civil pilots in various parts of the country revealed that all but two of several hundred men preferred turf fields. They explained that they had learned to fly on turf fields and felt more at home and safer on them. The ground has some resilience and, if the landing gear jams and a belly landing is necessary, both pilot and plane stand a better chance of coming off unscathed on turf than on a paved runway. Occasionally in emergency landings a plane will strike sparks from the paving and suddenly flare up. There is no chance of that with grass. Moreover, the turf field reflects no light whose glare might cause a pilot to misjudge landing distances as sometimes happens on paved runways.

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Airport at Le Grange, Ga., before proper drainage and surfacing projects were undertaken.

ATC

There's a lot more than meets the eye behind recent Air Transport Command change-in-attitude toward airline contractors, signalized by Maj. Gen. C. R. Smith's late fall speech in Oklahoma City. Smith and the ATC are putting his words into action by urging operators (believe it or not) to take more *Skymasters* and expand their services. This is in direct contrast to the old ATC attitude which handed out planes one at a time, and that grudgingly, contending that private operators could not do as efficient a job as the Transport Command and hinting that sooner or later all operations would be under the ATC banner . . . Chief reason for the turn-about is said to be that private operators have licked the maintenance problem, while Army maintenance has been less efficient and sometimes more than bothersome . . . The new policy is okay with the Civil Aeronautics Board and State Department, the Board having crusaded since the war began for more transports for private airline operators . . .

Civilian Peace, Inc.

While some aviation diplomatic experts appeared to spend the fall and early winter bent on wrecking international cooperation, lesser and civilian persons, led by the International Training Administration, Inc., did some practical co-ordinating toward international goodwill. The Administration, six months old the day before Christmas, made a semi-annual report showing that it has already brought hundreds of foreign nationals to this country for Government and private interests and arranged for their training in various aspects of American industry. Among these are more than 100 aviation students who have been placed by ITA in industry . . . Formed to serve as a liaison between foreign students seeking technical education and U. S. industry desiring trained personnel capable of returning to foreign fields (see FLYING, September, 1944), the Administration now has the support of 26 aviation companies. Among the new nationals represented in aviation are Turks, and 1945 is expected to bring students from India, China, Greece, Russia . . . ITA, privately owned, is non-profit-making. It is headed by Elliott Hanson, who was borrowed from U. S. Steel in 1940 by the Rockefeller Committee to organize a South American training program.

Airline Taxes

The report due to be submitted at year-end by the Civil Aeronautics Board to Congress on airline taxation cannot, of course, be considered the final word on the subject. It is simply an attempt—and a good one—to bring the complicated taxation problem into focus; but the problem of how to apply taxes to the airlines will, the Board findings indicate, be an increasingly difficult one . . . A review of the record shows, however, that notable progress has been made since CAB, a few months back, was asked by Congress under Public Law 416 to tackle the problem. The Congressional request came following Supreme Court's decision on the Minnesota Tax Case, ruling that the state under the constitution could tax Northwest Airlines' entire fleet, and leaving the door open for other states to tax parts of the fleet operating in their area. In sum, the question of multiple taxation was left unsettled, Court opinions putting the bothersome babe on the doorstep of Congress. Congressional Public Law 416 resulted, requesting the CAB to make a study . . . CAB member Oswald Ryan, who took over at this point, made it immediately clear that he did not consider the problem a Board monopoly but wanted advice from all the experts he could get in the industry and among private and state taxation officials. Thus the work got off to a good start in the fall.

Tax Philosophy

Although details of the CAB report to Congress on taxes are not available at writing, we learn that its basic philosophy is brief and to the point: while airlines owe a great deal of their early success to Government subsidies, it would be suicidal now to tax them beyond their capacities. Further, the more simple the tax structure, the better . . . Although Mr. Ryan and his advisers do not develop this premise in terms of international air traffic, confining themselves to the domestic field, they are acutely conscious of the handicaps under which the operators would work if they had to carry a heavy tax load into world competition against tax-free or even Government-subsidized foreign lines . . . Able and expert are the words to describe the advisory committee Mr. Ryan has gathered around him. They represent all interests concerned with the knotty problem. The group is headed by George W. Mitchell, tax economist of the Federal Reserve Bank, Chicago. Others include J. C. Collins of Mid-Continent Airlines, Amos Culbert of American, R. G. Lochiel of PCA, Budget Director Edward Logan of the state of Pennsylvania, Comptroller Joseph McGoldrick of New York City, Albert Noonan of the National Assessing Officers, Mississippi State Tax Commissioner W. H. Wallace, and George Watson, executive director of the Federation of Tax Administrators. Co-ordinating the work is able Irston R. Barnes, director of the CAB's economic bureau . . .

Post-war Putt-Putts

Good news for anybody interested in buying a private plane post-war comes from Alfred Marchev, president of Republic Aviation Corporation. We went to Long Island and had a talk with him the other day and found him crusading for economies in plane production which can be passed on to the consumer in the form of greatly reduced prices. Says Mr. Marchev: "We (the industry) have never done a top professional job in designing, producing, or selling private airplanes." He proposes to streamline all three in Republic's post-war amphibian and deliver it to the customer for $4,000 or less . . . While conventional private planes are being announced almost daily for the post-war market, don't be surprised if some manufacturers break into the market with revolutionary jobs. In this connection, we have a little more to report on the Chance Vought model, sometimes called the "Flying Hamburger," because it looks not unlike one in the air. It looks even more bizarre on the ground, we understand, with high landing gear to accommodate a huge prop—not unlike a giant mosquito. Most significant performance characteristics are said to be that the plane takes off almost perpendicularly, like a helicopter, and cruises at a speed running well into three figures . . . There are a variety of helicopter developments in the works, which may lead to purchasable models sooner than you think and Ryan might show up with a roadable; also General Aircraft, Consolidated, possibly Ford, Piper, Kaiser . . . NACA may be expected to release scores of war-secret developments to speed post-war private flying, and CAA is already working on aerodynamic improvements in private planes, with the reduction of noise and of landing and take-off speeds at the top of the list of problems to be attacked.

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BEER BOTTLE BLITZ

By
S/Sgt. BILL ELROD
as told to
Cpl. R. Z. SIMMONS

Even camp garbage comes in handy on Jap-harassing raids.

Sergeant Elrod (extreme right, rear) and other crew members on wing of their Flying Fortress.

IF THE kitchen sink had been in our plane we would have tossed that at them too. Our bomber was loaded with every type of unrelated object imaginable. Anything we got our hands on, from beer bottles to wooden cartons, we piled into the *Flying Fortress* to throw at the Japs on Rabaul that night.

The assignment was officially called a "harassing raid." Only one plane went out. The idea was to keep the Nips awake so that when the big show came off the next night they would be too drowsy to function properly. At least that's what we hoped.

We also had to put on a big front for the enemy. It was in the early days of the war and we had only a few planes. The only replacements available to us were a few condemned planes used by the 19th Bombardment Group in the Philippines which had been hastily repaired at Australian bases.

Staging these one-plane raids, we gave the Japs an exaggerated idea of our offensive power—and, incidentally, lessened the chance of losing many of our bombers on a single strike.

To show how it works, let's get back to this particular raid. Things started buzzing when a reconnaissance plane landed on our crude runway to tell of a concentration of Jap shipping in Simpson Harbor, Rabaul. Pictures taken by the aerial photographer showed an assortment of 60 vessels.

After examining the film, our S-2 officer decided it would be a good idea to risk a 40-plane raid on the objective. But first a "harassing raid" would have to be made that night.

Crew pilots were called into the old man's office to receive instructions. In those days the Japs were on the offensive and usually we were the target. Every crew was spoiling to get into any action it could. Capt. Bill Thompson from Canton, O., the skipper of our plane, was a little bigger than the rest of the pilots. Maybe that's the reason we got the job.

That afternoon our crew went down to outfit the plane. We checked the guns carefully. Then we filled a large additional tank of gas which we placed in the bomb bay. We knew we'd be above the target for quite awhile.

The ground crew—and anyone else who volunteered to help—scoured the area for scrap metal, shrapnel and bottles to toss out the waist window. Bottles were our favorite because they whistle when they fall through the air. Even lump garbage was welcome for our ammunition.

Don't get the idea we didn't use bombs. We loaded plenty of those into the plane too. It was just that we'd be above that

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Anything to keep the enemy awake.

As bombardier signals "over target," crewman tosses fragmentation bomb without aid of aiming devices. Weird whistle of bottles taped to bomb adds to raid's psychological effect.

HITCHHIKING TO HEAVEN

1. Corp. Constantine Striakatis demonstrates how to assume position for aerial pickup. He reclines on his back, facing away from poles and loop. A broad web belt pulls his legs tightly to his body as shown in photograph.

By KEN DAVIS

Aerial pickup device safely lifts humans off ground at 150 m.p.h.

AVIATION, a prolific source of queer experiences, has offered none more bizarre than those of the four Heavenly Hitchhikers—the only AAF airmen ever to be yanked from the ground into fast-flying airplanes.

Their names mean little as such, for none is publicly known. One of them already has ended his hitchhiking, a victim of infantile paralysis.

You may hear in the future of the return of Fred Brown from down the block, who was forced down on an ice floe ordinarily outside the scope of aerial rescue. But not outside the realm of the spectacular human pickup by which a man may be hauled from the ground into an airplane swooping by at upwards of 150 m.p.h. This revolutionary means of rescue for stranded Army Air Forces airmen may be used where seas are too rough to permit the landing of a seaplane, or where a helicopter cannot be obtained. Other tactical uses may be added to the list. It is reported a British version of the human pickup was used to return a secret agent to Allied intelligence headquarters.

Rough seas mean nothing to planes used for pickups because they do not land. AAF engineers at Wright Field, home of the Air Technical Service Command, found that the actual pickup produced less physical sensation than the acceleration of a motorcycle.

"The only sensation is a smooth whirr of air around you and then the ground disappears underneath," reported Lieut. Alexis Doster, first man to undergo this strange experience. "If I hadn't heard the wind I would hardly have known I was moving."

Lieutenant Doster was picked up September 5, 1943, in a Stinson SR-10 monoplane moving at approximately 125 m.p.h. He died a short time later in Egypt of infantile paralysis.

Experimentation was begun in July, 1943, after AAF engineers, seeking a means of rescuing flyers stranded for reasons of terrain, rough seas or floating ice, had spent some months engineering equipment.

Under standard rescue measures, seaplanes sometimes were forced to taxi hundreds of miles to reach calm seas for take-offs with stranded flyers. Ice floes sometimes blocked rescues by air. So once the equipment was set up at Wilmington, O., engineers of the ATSC equipment laboratory wasted no time.

They decided upon cargo containers as the initial pickup subjects. Inanimate, the containers carried recording instruments upon which the engineers later based the human pickup designs. It was easy, too, to vary weight with containers. Later, to put the pickup crew on its toes and to provide a transitional pickup subject, sheep were used.

There was some discussion among engineers as to the feasibility of using Barbette, a chimpanzee kept by the aeromedical laboratory for experiments.

"Boys," drawled Capt. Norman Rintoul, the pickup pilot, "if you use Barbette you'd better teach her to fly the airplane too, 'cause when she comes in one side, I'm going out the other."

2. Succeeding photos show aerial pickup of S/Sgt. Harry C. Conway, Jr. Here Sergeant Conway has just left ground after plane's tow rope has engaged pickup loop. A pickup's body does not drag along ground but gains altitude smoothly.

3. Now at a safe altitude, the tow rope is being hauled in.

4. At end of reel, Sergeant Conway climbs up guide, grabs door sill and clambers in with winch operator's help. Long knives anchored to wheels cut loop if plane comes in too low.

After Doster's ascent, pickups of humans were deferred for more than a year, until on September 23, 1944, S/Sgt. Harry C. Conway of the AAF and Capt. John Peter Lee-Warner of Britain's ground forces rode the nylon rope aloft.

Sgt. Constantine Stiakatis became a fourth member of the unique society October 7, 1944, bringing to about 200 the number of pickups of cargo containers, sheep and humans in the months of work necessary to perfect the procedure.

Sheep were used as transitional pickup subjects between cargo containers and humans principally because they are docile and easily obtained—or so the engineers thought. After completing reams of forms necessary to purchase a sheep, Army style, they began to doubt if sheep were obtained easily, however. Days thus were consumed, to which were added more days preparing the pickup test. At this point, engineers began to doubt if sheep were the ideal subjects after all. It developed that the sheep were in what

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5. Climbing into plane, Sergeant Conway has completed trip from the ground in 2 min. 45 sec. The "jolt" of a human aerial pickup is less than jumping off a chair stiff-legged.

Fairey Firefly still clings to observer-navigator theory for ship-borne fighters.

The Me-163b, Germany's new rocket-powered fighter, has better than 500-m.p.h. speed.

British rate the speed of the twin-jet single-seat Me-262 at more than 480 m.p.h.

Fighter Progress in BRITAIN

By Maj. OLIVER STEWART, MC, AFC

Britain's conventional fighters have reached their design limits. Rocket and jet planes are next step.

Major Stewart, editor of the British magazine, Aeronautics, has flown more than 100 different type planes since he served as pilot in World War I. This first article in a series for FLYING analyzes British fighters.

BRITISH fighter development reached a critical point recently when three new aircraft went into service in the Royal Air Force and the Fleet Air Arm of Britain's Royal Navy. They were the Vickers-Armstrong's *Spitfire XIV*, the Hawker *Tempest* and the Fairey *Firefly*. They represent the best that British designers can do with the conventional fighter formula. The next step must take them into the region of new prime movers, jets and rockets, and new shapes, tailless and rudderless.

Already well-known to the inner circles of Allied aviation, the three new machines were held to be less well known to the enemy, so that the Air Ministry of Aircraft Production maintained a publication ban until September for the *Spitfire XIV*, until October for the *Tempest* and until November for the *Firefly*.

The *Firefly* ship-borne fighter carries in its design a special tactical idea which will be examined later. The *Tempest* and *Spitfire XIV* are general duty fighters and their good and bad features are brought out when they are compared with some of the enemy aircraft they are meeting in the battles in western Europe. The Focke-Wulf FW-190 may be said to be a direct translation into German of the *Spitfire XIV*; but the Messerschmitt Me-262, the Messerschmitt Me-163 and the Heinkel He-280 are German innovations.

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Hawker Tempest met German "robomb" and jet plane threat with greatly increased power —a 24-cylinder, 2,200-h.p. engine—but with no great novelty in aerodynamic design.

FLIGHT
AND THE RIGHT MENTAL ATTITUDE

By JOHN R. HOYT

The four cardinal rules of this veteran instructor are:
Relax. Fly the plane. Don't let it fly you. Do something!

NEARLY 100,000 students underwent flight training last year—and by that token there were from 20,000 to 40,000 washouts. In all that vast number of carefully selected students an inquiring reporter could find hardly a single one who would agree that he should have been eliminated or that he was not able to fly an airplane.

What is more nearly correct is to say: "Those who were eliminated were not good military pilots." Almost anyone can be taught to take off, make a few turns, and land; but not too large a percentage of our young men can do that and also fly a military mission. Why do they fail? What is wrong with their outlook on flying—what must one do to form the *right mental attitude*?

That one question (or variations of it) has been asked instructors more often than any other query. Students who are doing poorly in the first few hours of flight training incessantly ask, "What is wrong with my flying? I know what I ought to do but I can't seem to be able to do it!" Or, upon being asked by the flight instructor why they turned downwind instead of upwind on the simulated forced landing, they can only shake their heads and admit, "I don't know."

There is but one answer to the question of flight failure, and it lies in the mental approach to the problem. Granted that the flight surgeons have provided an instructor with physically sound students of average intelligence, one might assume that anyone can fly—just as it is assumed that "anyone" can drive an automobile. Of course "anyone" *cannot* drive an automobile and do it successfully, as the annual rate of accident fatalities indicates.

The same principle applies to flying, but more so.

An accident in a plane similar to a banged fender in an automobile might mean a fatal crash. Bumping the car parked next in line, if done in a plane, would mean a $200 repair bill. Underestimating the distance to the next car, losing one's way, venturing out in bad weather—all of those mistakes are far worse when committed in an airplane. Some of them are final errors in every sense of the word.

It is obvious that the mistakes a pilot makes as the result of poor thinking or lack of thinking at all are to blame for many washouts. Elimination is the protective device of the Air Forces, protection against error in combat, to prevent damage to materiel, and to give the student a chance to survive. Instructors are alert for clues that will give some indication of how a student thinks, what he is like inside, and what his mental attitude is.

Just what is that *mental attitude?* Let's take the case of Student A, who is going out for his first ride. He has been adequately instructed about the controls and how the plane flies, but has never flown before. What should he look for—what outlook should be assumed in order to assimilate the instruction?

A few simple pointers will mean the difference between success and failure if

(*Continued on page 118*)

Good student-instructor relations are essential in learning under the tense conditions of flight.

HAVE YOU SEEN ?

This is a Jap Suiho-class carrier, in the process of being sunk by U. S. Navy planes. Unusual camouflage on deck was supposed to make the carrier look like a battleship.

Large number 18 on flight deck bow identifies this carrier as the Navy's new U.S.S. Wasp (CV-18), an 885-foot-long Essex-class carrier.

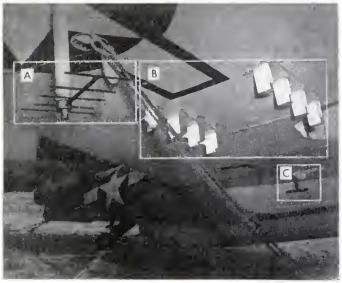
Wilford Gyrocopter would have two 1,050 h.p. engines, cruise at 119 m.p.h., carry 16 passengers, cost 5c per passenger mile to operate.

Laister-Kauffmann Trojan Horse (CG-10A) transport glider carries six tons of freight or 42 fully-armed men. Wing span is 105 feet, length 67 feet. It is loaded from the rear, must be towed loaded by a C-54 or B-17.

General Motors' new two-cycle aircraft engine (shown in test Cessna) is soon to go on market.

New Stinson Voyager has 125 h.p., cruises at 112 m.p.h., carries four, costs about $5,000.

This is an artist's conception of a new Westland design, recently shown in a British publication. It appears to be a high-speed, twin-engined, single-seat fighter.



Released to FLYING for the first time by the U. S. Navy is this exclusive photograph of previously-restricted aircraft installations. Shown on the underside of the wing of a General Motors Avenger (TBM-3) are its recognition radar antenna (A), the new Type Zero rocket launchers (B), and a radio altimeter antenna (C). The radar antenna shown is reported similar to a Jap type.

North American XB-28, tested in 1942, had some of first remote-control gun turrets like those now used on the Superfortresses.

Because Boeing Kaydet (N2S-5) trainers ground-loop easily, light wood skids were put on wing tips. Note winter cockpit enclosure.

New Lockheed Saturn will have two 525 h.p. engines, carry 14 passengers, cruise over 200 m.p.h. It was designed for feeder airlines.

One RAF Beaufighter has put a salvo of rockets into this German ship, while others (foreground) from a following plane can be seen in flight.

Rockets and Aircraft

By CURTIS FULLER
Associate Editor of Flying

Rocket propulsion has transformed armament and is on the threshold of revolutionizing aircraft.

Above, RAF ground crew inserts rockets in rail-type projectors. U. S. Navy used similar projectors for its first rockets, as indicated by rocket-equipped Avenger, right.

THE most revolutionary ordnance development of this war has been the refinement of rocket-propelled missiles. Rockets have transformed the airplane into a heavy artillery piece—with results in aerial tactics and strategy which are just beginning to be exploited.

The Army Air Forces rocket-equipped fighter-bombers were a major reason for the Allied victories in France. Field Marshal von Kluge, in a secret telephone journal captured by our Army, reports that the fighter-bombers "made movement almost impossible. The troops have suffered high losses in men and equipment by strong air activity, and morale has greatly suffered."

In one two-day period, a group of rocket-equipped *Thunderbolts* flying 64 sorties destroyed 12 tanks and damaged 13, and destroyed or damaged six other vehicles.

Substantiation of claims is difficult because of the havoc wrought by rocket fire. When a rocket penetrates a tank and explodes it frequently sets off the tank ammunition—resulting in a destruction which is not unlike that produced in equipment abandoned and destroyed by

the enemy. Verifications have to be based on finding parts of rockets within the target—and such parts cannot be found if the target is destroyed totally or if the ground advance does not reach the target area until some time after the attack.

Nevertheless, one unit of the Ninth Air Force in a two-month period fired 1,117 rockets on 323 sorties to destroy 371 targets and damage 105. Here is a breakdown of the verified results:

Targets	Destroyed	Damaged
Locomotives	35	0
Tanks	85	29
Armored Cars	15	1
Motor Transports	164	23
Gun Positions	19	6
Hangars	9	5
Warehouses, Facories, Etc.	6	4
Cars	36	35
Ships	2	2
Total	371	105

The U. S. First and Third Armies are supported by Ninth Air Force *Thunderbolts, Lightnings* and *Mustangs*. The British Second Army is supported by *Typhoons, Mustangs* and *Spitfires*. All of these planes are equipped with rockets, and can carry bombs as an alternative. *Airacobras* and *Warhawks* are also equipped with rockets, though they are not now used in France.

In August alone, the Ninth Air Force dispatched more than 23,000 fighter-bombers, many of them equipped with rockets. They destroyed or damaged more than 450 German aircraft, 10,000 motor vehicles, 2,000 railway cars, 500 tanks and 400 field guns.

Rockets are good incendiary weapons. They have had excellent results in low-altitude surprise attacks against enemy airfields. They have proved exceptionally effective against shipping lanes and communication lines.

Great hush-hush surrounds Allied rocket development—except that rockets are being used on an increasing scale. New rocket powder factories were being built while factories producing conventional explosives were being closed down. Despite official reticence, however, a reasonably complete outline of the rocket puzzle can be pieced together by juggling the jigsaw bits of both British and American information.

The battles in Normandy witnessed the first big-scale use in Europe of rockets fired from aircraft. They were fitted to *Typhoon* fighters of the Royal Air Force. However, a limited use of rockets in warfare can be traced back many centuries.

Rockets were used in Chinese warfare at least as early as the 13th century. It was a British artillery brigade, reorganized as rocketeers, which caused the American troops to break at the battle of Bladensburg and pave the way for the surrender and subsequent burning of Washington. Francis Scott Key was not romancing when he wrote of "the rockets'

New-type Navy rocket launchers, seen on wing of Wildcat, appear to be little more than hooks on which rocket is suspended. The Navy rocket itself is shown below.

The tremendous scope of the aircraft rocket program is indicated, left, by this assembly line with its tiers of Army launchers under construction. Above, a rocket is loaded on its launcher mounted on a Thunderbolt.

Terrific advance in aircraft firepower is indicated by these three bazooka rocket launchers mounted on wing struts of light Piper Cub artillery-liaison plane somewhere in France.

red glare" in his "Star Spangled Banner." Rifled cannon developed such accuracy by 1850, however, that rocket brigades were disbanded.

The development of rocketry was left to scientists and amateurs until 1900, when a chemist named Charles Monroe evolved the principle of the "bazooka," finding that a tube open at both ends was an excellent launcher of explosive rockets. This "Monroe ring" or hollow cylinder explosive principle was employed with limited success by the Nazis during their Belgian campaign.

The story of the modern rocket began in 1934, when British intelligence discovered that the Germans were evincing a keen interest in such development. The British immediately launched an intensive research program and by September, 1938—the time of Munich—the research was very nearly complete. Trial rockets were made and filled and the rockets officially called "U.P." (Unrotated Projectile).

By March, 1939, everything was ready for full-scale tests. Because of climatic conditions in Britain it was impossible to carry out the trials there and a group of scientists went to Jamaica for the purpose. The trials were concluded successfully in about two months.

Many difficulties were met in reaching substantial production, however. The rocket propellant was difficult to handle. The work demanded great accuracy. The workers had to be trained to new and strange tasks. Nevertheless, production was underway in 1940.

The British rockets in their original form were not designed for aircraft but for shooting aircraft down. Rocket batteries were arranged to be fired in salvos against low-flying dive-bombers. Meanwhile one rocket battery was assigned the job of investigating the effect of firing very large salvos against high-flying night bombers. This battery went into action in the Spring of 1941 and destroyed a night raider on its second salvo.

It was but a step to develop rockets for use on airplanes. The R.P. (Rocket Projectile) successfully used by the RAF Coastal Command *Beaufighters* on enemy shipping and also by RAF *Typhoons* and Fleet Air Arm *Swordfish* is simply an adaptation of the projectile with which the rocket-firing antiaircraft batteries were equipped. In the first attack by rockets against a stranded merchant vessel, six hits were obtained.

Wing Commander Roderick Hugh McConnell, DFC, was commanding officer of the first *Beaufighter* squadron to be equipped, in June, 1943, with rocket projectors. His first attack against a medium-sized German merchant vessel in a Norwegian Fjord was successful.

In the United States, the lead in rocket development was taken by the Navy, according to Maj. Gen. Elwood R. Quesada, chief of the Ninth Tactical Air Command. The first airborne rocket attack made by U.S. Navy planes against the Japs sent a 450-foot cargo ship to the bottom of the Pacific. Lieut. Ray T. Lemmons, piloting the plane, reported: "I came out of my dive, sighted on the ship's side, and let the rockets go. There was a boom, then a swish. A second later I pulled the bomb lever and the rockets and bombs smacked that ship like the old one-two in boxing."

Back of that first rocket attack was some fast work in a California production plant. After the Navy had made up its mind what was best, this plant got word one Thursday that the Navy wanted 252 rocket launchers—then a highly secret device—by midnight of the following Thursday. The last weapon was completed one minute before the deadline.

The Navy went on to use rockets in attacks against submarines in both oceans and in attacks against Japanese warships and land troops in the Pacific. Rockets are known to have been used against German subs in the Atlantic early in 1944. On one strike, two Grumman *Avengers* scored three certain and four probable hits against a submarine. Besides the damage they would inflict on such craft directly, the rockets undoubtedly are extremely valuable in driving deck gun crews to cover during a bombing run.

The first big assignment of the rocket-equipped *Typhoon* fighters came a few hours after the British and U.S. troops landed on French soil. They were ordered to put out of action every enemy radio station from Belgium to Brest. Subsequent estimates claimed that 95 per cent of the radio chain had been silenced. The odd five per cent was jammed and the entire German warning system was thrown into confusion. A string of silent radio stations along the coastal belt meant that enemy headquarters inland failed to receive adequate warning of the invasion and contributed to saving thousands of Allied lives.

On the western front, the Germans first used their rocket-equipped planes against American aircraft. They seized on the rockets in an attempt to overcome the firepower handicap imposed by our devastating .50-caliber machine guns. AAF pilots, on the other hand, have used rockets mainly against ground targets.

(Continued on page 146)

Jet-assisted take-off, or Jato, on Martin Mariner. Each unit generates the equivalent of 300 horsepower for a few seconds and permits more rapid take-off with heavier loads.

Shakedown Cruise

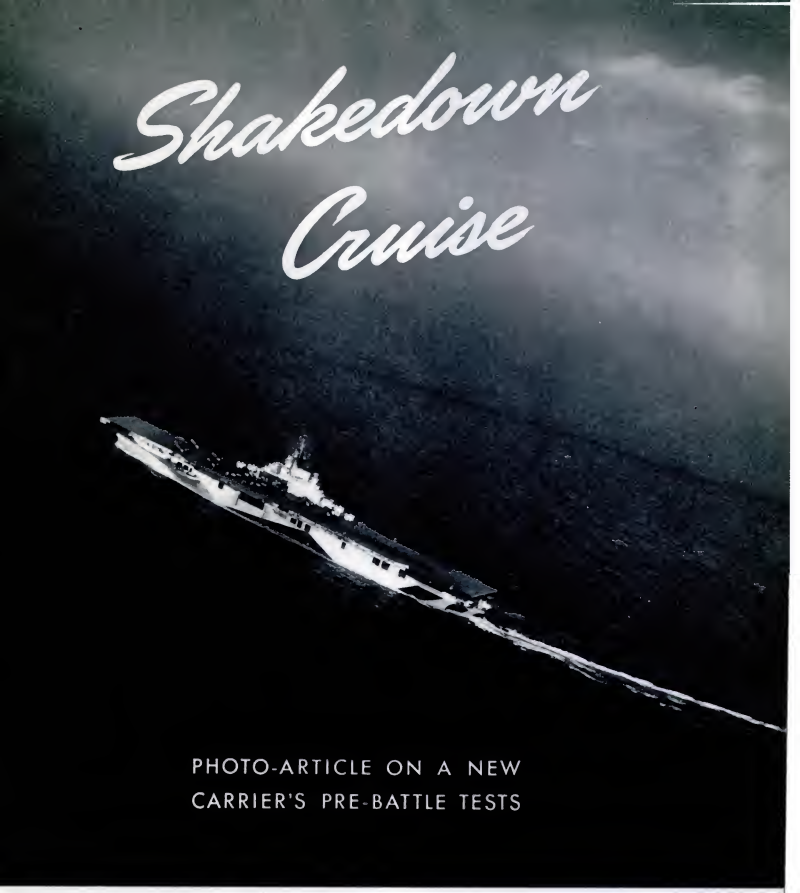


PHOTO-ARTICLE ON A NEW CARRIER'S PRE-BATTLE TESTS

By JOHN R. WHITING

Managing Editor, Popular Photography. Photographs by the Author

NEXT to going into battle against an enemy, the shakedown cruise is the most realistic mission on which a new aircraft carrier can go. This article, and the photographs that accompany it, tell the story of a recent shakedown cruise. The carrier was the U.S.S. *Bennington;* the writer accompanied her on the major part of her cruise.

The *Bennington*, an *Essex*-class (CV) carrier, was launched at the New York Yard on February 26, 1944. Her keel had been laid on December 15, 1942. Fully outfitted, she displaces 27,100 tons. Her flight deck is 885 feet long and a recent directory of U. S. Naval vessels estimated that *Essex*-class carriers have a hangar-deck capacity of more than 120 aircraft with wings folded.

It is on the shakedown cruise that a new carrier's whole crew—flight person-

Bombs and baggage go aboard the Bennington's hanger deck at the Norfolk Navy yard. Two CVE's can be seen in the background. That farthest away is British. Note Vought Corsairs on its flight deck.

First landing aboard is made by the skipper of the carrier's scout bomber squadron, flying his Helldiver. If the cameramen in foreground suspects landing will be unusual, he shoots a movie record.

Landing signal officer signals an approaching pilot he is too high. Seamen with microphone is LSO's talker, relaying instructions to air officers on the bridge. Seamen with binoculars is hook spotter.

Through flying for the day, this Helldiver is waiting to be towed forward by a small tractor. Planes then go to hanger deck on an elevator. Stubby rods on Helldiver's wings are rocket launchers.

nel as well as those who operate the ship —first get to meet each other. It was here that men of the *Bennington* had their first opportunity to work together. When the *Bennington* sailed from the Norfolk, Va., Navy yard one day recently, many of the men aboard her had been shipmates for only a few hours. But by the time this writer went ashore at the end of the most crucial part of the *Bennington's* shakedown cruise, every man aboard intimately knew the shipmates with whom he had to work. Even the deck officers and crewmen had learned the idiosyncrasies of individual members of the carrier's air group well enough to recognize certain pilots just by the way they flew their aircraft onto or off the deck.

When she lifted anchor at Norfolk, the *Bennington* had all her permanent crew

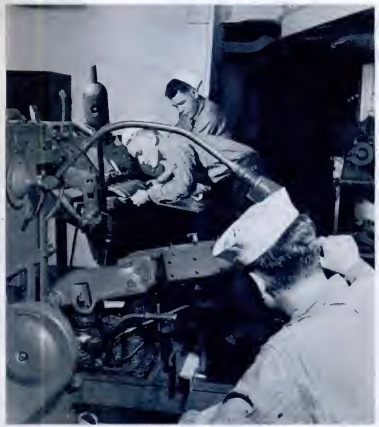
→

Comdr. E. E. Colestock (wearing white scarf) is carrier's air officer and is standing in "Primary Fly." White flag indicates that landings are in progress. Note Helldiver going down on deck elevator.

Hangar deck plane-handling crew pushes an Avenger off forward elevator, following yellow-sweatered officer's hand signals. Plane-pushers are identified by blue helmets, fire fighters wear red.

After flight quarters, air officers gather in ready room for an analysis of day's activities. Commander Colestock leads the discussion. Lieutenant in foreground is LSO seen at work on page 36.

Maintenance work is done on the hangar deck, much of it at night. Various workshops surround this area. Helldivers above have been secured for the day. Spare planes can be hung from the ceiling.



Late at night technicians work in carrier's machine shop. Here they are forming dural to repair a plane wing. Other shops nearby include those for instruments, engines, propellers, armament.

aboard. The air group stayed ashore for last minute preparations, and flew out to the carrier the next day. The arrival of her planes at the rendezvous point at sea marked the *Bennington's* first full-fledged Flight Quarters. Flight Quarters were called for 0730 (7:30 a.m.) and, almost as soon as the bullhorns had called officers and men of the Air Department to their stations, the first planes were overhead. They immediately broke formation and went into the landing circle in threes and fours. This was the first of the many tense moments ahead. The landing signal officer—the man for whom the whole carrier operates at this instant—planted his feet firmly on his platform on the *Bennington's* stern and started to "fly" the first plane in. His two yellow paddles moved constantly, quickly, automatically, as the plane's pilot, his head over

→

Next day a heavy fog prohibits flying. This Hellcat is one of several planes tied down on flight deck to give hangar-deck crews more room to work. Heavy guns are elevated to give greatest deck clearance.

With flight quarters secured because of the weather, officers can use library, table tennis, rowing machines, handball and other recreational facilities. Synthetic training devices also are in use.

Non-flying days see plenty of studying. Rooms like this house two junior officers, have two bunks, two desks, two lockers. Porthole points downward because room is forward of carrier's slanting bow.

Most popular spot aboard for officers is the wardroom. Here, meals are eaten, chess and acey-deucy are played, and airmen just sit and shoot the breeze. Coffee (for rear of photo) is ready 24 hours daily.

Flight quarters sounds with the return of good weather next morning. Here, the first Avengar is pushed off hangar deck onto deck-edge elevator, and is in position on flight deck within a few seconds.

the side of the cockpit, reacted instantly to the LSO's every move. Those hypnotic paddles suddenly rose to form a broad V and the pilot eased forward on his control stick to lose a little altitude. One paddle dipped slightly and the pilot dropped a high wing. Then, suddenly, the LSO's right arm snapped down and across his chest. "Cut!" The pilot's left hand snapped the throttle shut, his eyes turned from the LSO to the deck ahead as he dove his plane slightly onto the carrier's stern. The plane's hook caught No. 3 wire, the craft was hauled to a quick but gentle stop—and the *Bennington's* first plane was aboard. Swell start, too; catching the No. 3 wire.

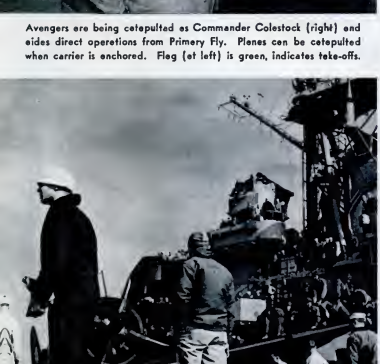
The pilot climbed out of the cockpit. He was Comdr. G. L. Heap, commanding the *Bennington's* entire air group of Grumman *Hellcats* (F6F-5), Curtiss *Helldivers*

Plane handlers push a Helldiver off the forward elevator into position on the Bennington's bow. Note rocket launchers on the folded wings. Destroyer in background was not escorting the Bennington

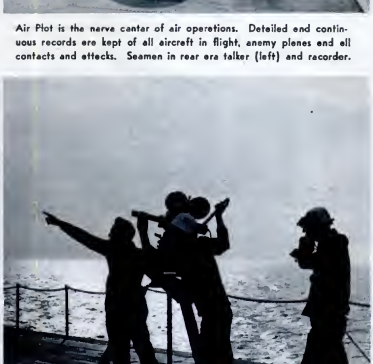

22

Avengers are being catapulted as Commander Colestock (right) and aides direct operations from Primary Fly. Planes can be catapulted when carrier is anchored. Flag (at left) is green, indicates take-offs.

Air Plot is the nerve center of air operations. Detailed and continuous records are kept of all aircraft in flight, enemy planes and all contacts and attacks. Seamen in rear are talker (left) and recorder.



Only mishap was this Helldiver's barrier crash. Plane came in too high and too fast, missed all arresting-gear cables. Crew escaped injury. Plane was below on hangar deck for repairs within very few minutes.



Antiaircraft practice by carrier's gun crews is recorded in motion pictures, is studied later by gunnery officers. Target was a sleeve, towed by a shore-based Marauder. Gunners made an excellent first score.

(SB2C-3) and General Motors *Avengers* (TBM-1). He walked across the flight deck to the *Bennington's* island, climbed a ladder to Primary Fly and shook hands with Comdr. E. E. Colestock, a Naval Academy classmate. Now the *Bennington's* shakedown went ahead full blast.

In quick succession the rest of the carrier's air group thumped onto the flight deck. Within a few minutes all were aboard; several had caught the No. 1 wire, few caught higher than No. 4. The cruise's first landings were hot; everyone aboard felt good. The *Bennington* started a turn out of the wind, now that her planes were aboard. During landings and take-offs, she must steam directly into the wind so that there is a minimum of 20 knots (23 m.p.h.) over the flight deck. By now, nearly all her planes had gone to

(Continued on page 88)

THE BENNINGTON'S LANDING SIGNAL OFFICER IN FLUORESCENT-LIGHTED NIGHT UNIFORM.

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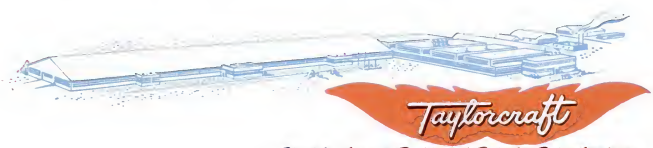

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This is not an actual combat photograph—it is drawn to illustrate the accuracy with which a Black Widow can strike in the dark. Bomber shown exploding from hit gasoline tank is the Messerschmitt Me 210

It is designed to carry 2 or 3 specialists . . . to fly fast and range far . . . to locate and destroy the enemy in darkness or daylight

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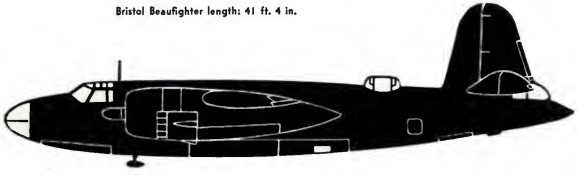
The planes are: 1. British Beaufighter. 2. Douglas Dauntless dive bomber. 3. British Spitfire. 4. Consolidated Catalina flying boat. 5. Russian fighter. 6. Curtiss Helldiver dive bomber. 7. Mitsubishi Zero fighter. 8. Cessna Bobcat.

MISTAKEN IDENTITIES

Bristol Beaufighter length: 41 ft. 4 in.

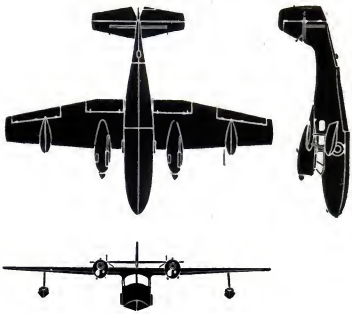


Martin Marauder length: 58 ft. 2 in.

THOUGH they differ greatly when seen beside each other to scale, the British Bristol *Beaufighter* and the American Martin *Marauder* have been mistaken for each other when seen for a quick second. The twin-engined British fighter is smaller and stubbier and its engines project ahead of the fuselage nose. Their differences should be noted, as both types are flying in the same war theater.

GRUMMAN WIDGEON

Utility Amphibian

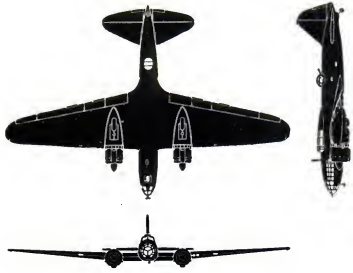


PERTINENT FACTS: Operated in large numbers by the Navy, Army, Coast Guard and the RAF, the *Widgeon* was a popular sportsman's plane before the war. Powered with two 200-h.p. Ranger air-cooled engines, it is a five-place airplane and cruises at 145 m.p.h. Gross weight is 4,500 pounds. Wing span is 40 feet, length, 31 feet; height, nine feet. Range is 750 miles, service ceiling 15,000 feet. Fuel capacity is 108 gallons.

WHAT TO LOOK FOR: A high, cantilever-winged monoplane, the *Widgeon* has the typical Grumman squared-off lines. The wing-tip floats are fixed and the landing gear retracts into the boat hull. The inline engines appear to be liquid-cooled, but actually are air-cooled.

ILIUCHIN DB-3F

Medium Bomber

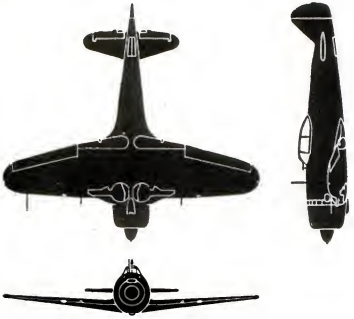


PERTINENT FACTS: A standard of the Russian air force for some time, the DB-3F still is used extensively. It is powered with two 1,100-h.p. M-88 air-cooled radials which give it a top speed of 300 m.p.h. at 21,000 feet. Wing span is 70 ft. 3 in., length, 47 ft. 7 in. Service ceiling is 30,700 feet. It carries two tons of bombs and three 7.6-mm. machine guns. This airplane was the first Russian bomber to bomb Berlin.

WHAT TO LOOK FOR: This is a low-wing cantilever monoplane, with slight leading-edge taper and sharp taper on the trailing edge. The tail unit bears sharp, triangular lines.

NAKAJIMA TOJO

Fighter



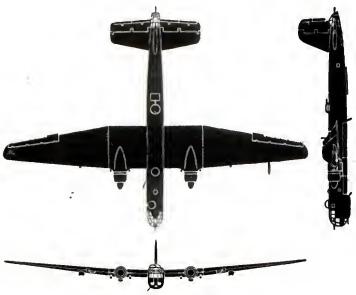
PERTINENT FACTS: This is the Jap fighter that has been mistaken for the Republic *Thunderbolt* at first glance. A comparatively new design, it is powered with a Nakajima Type II 1,450-h.p. air-cooled engine which gives it a top speed of more than 370 m.p.h. at 23,000 feet. Armament is the equivalent of two .30-caliber and two .50-caliber machine guns. Wing span is 31 feet, length is 29 ft. 3 in. Service ceiling is about 30,000 feet. A jettisonable fuel tank can be hung under the fuselage.

WHAT TO LOOK FOR: Tojo is a conventional low-wing monoplane, with sharply tapered trailing edge. The tail unit appears to be proportionately small. The rudder and vertical fin project a pronounced distance behind the horizontal surfaces.

FLYING, February, 1945.

HEINKEL He-177

Heavy Bomber



PERTINENT FACTS: The He-177 was to have been the Luftwaffe's answer to the American *Flying Fortress* and British *Lancaster*. But persistent troubles, mainly with the engine installations, has kept this airplane in the background. It is powered with two twin-engined units, each pair of engines driving one propeller. Each engine unit develops 2,400 h.p. Top speed is about 280 m.p.h. Wing span is 103 ft. 6 in., length, 67 feet; height, 21 ft. 10¾ in. Gross weight is 68,000 pounds.

WHAT TO LOOK FOR: The wing has a rectangular center section and tapered cantilever wing panels. The fuselage is long and rectangular, with a bulging nose. The tail unit is large and rectangular. The landing gear is conventional and fully retractable.

FLYING, February, 1945.

The author in the cockpit of OX-5 Travel Air.

I Learned About Flying From That!—No. 64

By GEORGE McCALLUM

This pilot's plane was nose heavy after being rigged for racing. He won the race, but when he entered the dead-stick landing contest he dived in at a 75° angle.

TAKE a tip from one who knows—never try to fly a plane that is out of balance!

If you've read accounts of airplane crashes where the pilot and his passengers were killed, you're familiar with the statements: "cause of the accident is yet to be determined." Eyewitnesses usually tell the coroner's jury, that "the plane was in normal flight when it suddenly dove into the ground." That very thing almost happened to me once. And that's how I know many of these "cause is yet to be determined" crashes are the direct result of sudden or abnormal changes in cargo or passenger loading.

Weight and balance are items that should be given most careful study by the pilot before take-off. Of course, there are occasional changes about which he does not know. A pilot of a DC-3 recently stated in this column that he had almost fatal trouble because someone had removed 600 pounds of ballast he presumed he had in the tail of his plane.

Center of gravity, according to the dictionary, is "the point about which all the parts of a body exactly balance each other." It sounds simple, but if a pilot wants to save his insurance company considerable money and his family a lot of grief, he'd better not take liberty with "c.g." That's a lesson I learned—the hard way.

It happened on the opening day of a week-end air show sponsored by the American Legion to dedicate the Modesto, Calif., airport in April, 1931. The first event was a cross-country air race from the Oakland Municipal Airport to Modesto. All entries were to take off in order of the top speed of their planes, specified by the manufacturers. First plane to cross the line was to be the winner.

At that time I was working with a friend, Bob Stewart, who had recently purchased an OX-5 Travel Air. His plane was equipped with an adjustable steel propeller and had a rebuilt Millerized engine. In addition, he had a set of racing struts and we thought we had more than an even chance to win the race.

The racing struts were installed as a means of obtaining all possible speed. They were identical with the two rear standard struts, except that they were about four inches shorter, thus eliminating the angle of incidence in the wing.

With an engine that developed 1,750 r.p.m. in the air, we took the Travel Air off the field in the first test hop. The test revealed that the nose was extremely heavy. However, we completed an airspeed check over a closed course which indicated 109 m.p.h.

Several times the plane was re-rigged and test-flown, but the nose heaviness could not be removed. Flying wires were extended to their limit and the aileron adjustment bolt was extended about six inches. But in order to fly the plane we still had to maintain back pressure on the stick, with the engine doing 1,700 r.p.m. and the stabilizer lever in the extreme aft position.

Then came the day of the race. The 15 entries included an Aeronca, two more OX-5 Travel Airs, Wacos and a J-6 300 Cessna. Take-offs were made with slower planes leading the way.

Approximately 35 minutes after the take-off, I had crossed the finish line at Modesto averaging 120 m.p.h., which was about 20 m.p.h. faster than the rating given the plane by the manufacturer. I'd won the race and first prize money.

Second event was a dead-stick landing. Excited over my earlier victory, I decided to enter this contest too. But when I started the engine, I noticed a water leak which proved to be a cracked flare in the overhead water line tube. I made a hurried trip back to the hangar and had a new line installed. When I returned, the last contestant was just gliding in to a dead-stick landing. The starter, however, allowed me a chance to compete, providing I "hurry it up!"

I made a take-off in almost record time, climbed to 1,500 feet and cut the engine

(Continued on page 135)

Official U. S. Army Forces Photo

Beechcraft AT-11 Bombardier Trainer

BOMBARDIER AT WORK

A bombardier's training is not easy. It demands long days and nights of intensive study and work. That is one reason why American bombardiers have made such excellent scores over enemy targets. Since 1940 most AAF bombardiers, and a large percentage of our country's navigators and pilots as well, have been trained in Beechcrafts. The high regard that these officers have for Beechcrafts is one of our most valued assets.

Beech Aircraft

CORPORATION

BEECHCRAFTS ARE DOING THEIR PART

WICHITA, KANSAS, U. S. A.

Eclipse

ELECTRONIC DE-ICER TIMER

FOR USE IN CONJUNCTION WITH ECLIPSE ELECTRONICALLY CONTROLLED MANIFOLD DE-ICER SYSTEM

Eclipse Electronic De-Icer Control Unit weighs only 6.5 lbs. —a weight saving of 10 lbs. over previous unit.

Flexibility of De-Icer Control

VERY LIGHT ICING CONDITIONS—Turn switch to No. 1 position. After at least 1/8 inch of ice has accumulated on leading edges, but not less than 10 seconds after turning switch, press button and release. De-Icers will operate through one 45-second cycle and stop. Press button and release for additional single cycles when required.

LIGHT TO MODERATE ICING CONDITIONS—Turn switch to No. 1 position, wait 10 seconds, and then turn switch to No. 2 position. De-Icers will operate automatically with one-minute intervals between 45-second cycles.

SEVERE ICING CONDITIONS—Turn switch to No. 1 position, wait 10 seconds, and then turn switch to No. 3 position. De-Icers will operate automatically with no delay between 45-second cycles.

HIGH ALTITUDE—Turn switch to No. 4 position and De-Icer cycle will increase to 67 seconds, repeating automatically without delay between cycles.

APPLICATION

To effect complete ice removal by the De-Icer method, accretion of ice must be permitted to develop a tensile strength sufficient to overcome adhesion between ice and inflated boot. Accordingly, for effective ice removal, the De-Icer system must be controlled for both rate of accretion and texture of ice formation. The Eclipse Electronic De-Icer Control successfully accomplishes this.

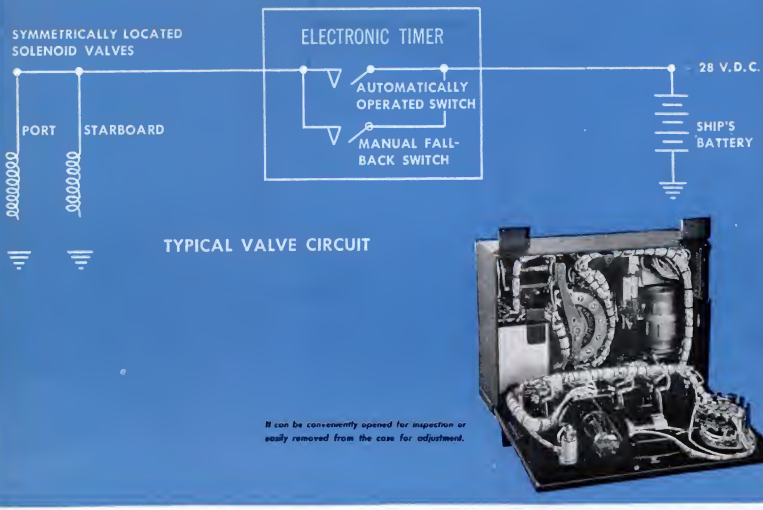
The Electronic Timer is designed for use in conjunction with the Manifold-Solenoid De-Icer System, to open the boot inflating valves automatically, in the proper sequence, and for the effective time intervals.

PERFORMANCE

The Eclipse Electronic De-Icer Timer provides automatic or manual remote electrical control of De-Icer boot operation.

BUY MORE WAR BONDS AND KEEP THE BONDS YOU BUY

Eclipse



TO CONTROL THE BOOT VALVES AUTOMATICALLY IN PROPER SEQUENCE AND FOR THE PROPER TIME INTERVALS

The Electronic Timer incorporates a means of controlling frequency and duration of De-Icer operating cycles to suit any type and rate of ice formation.

This flexibility of control is provided in four different variations—"single cycle," "60 second dwell," "0 seconds dwell" and "50% increase."

Purely as a safety fall-back, a row of auxiliary hand-operated switches are provided to operate the valves directly. This switch control permits manual operation of De-Icer cells as required.

DESIGN

In the Eclipse Manifold-Solenoid De-Icer System, single span-wise suction and pressure manifolds provide a simplified, lightweight installation with negligible line losses.

Although primarily designed for *new* aircraft, any manifold solenoid De-Icer System now using the Eclipse *Mechanical* Timer can be inexpensively and quickly converted to the *Electronic* De-Icer Timer and the mechanical timer eliminated, by merely changing the AN connector on the existing cable.

Laboratory tests under room, cold, sea level and altitude conditions show that the Electronic De-Icer Timer will function, without adjustment, for more than 1,000 hours of icing time.

The Electronic De-Icer Timer can be wall or flush panel mounted. It is so designed that it may be opened for inspection from the front while in operation, or for complete removal from the case. Compact design, the unit measures 8⅞" long, 6⅛" high, 3¾" deep and weighs 6.5 lbs.

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★ *Private Owners and Fleet Operators Can Depend on SPARTAN for Expert Overhaul Work at Reasonable Prices*

Letters

FLIGHT TEST FOR THE DEAF

Sirs:

I am one of many air-minded deaf people who are wondering if we will be permanently "grounded." Why is it that we are not permitted to fly? I know that radio is one answer. But couldn't another person handle the radio when it is needed?

VIRA M. ZECK

New York, N. Y.

● Provisions have been made for the deaf to fly. Such persons should make written application to the CAA medical director in Washington, D. C., for a special flight test. The petition should be mailed at the same time application is made locally for the CAA physical examination. If the physical exam is passed and the flight test is satisfactory, instructors are permitted to pass the applicant for student licensing. He may solo and fly cross-country, but he may not carry passengers.—ED.

JACK PICKS A JILL

Sirs:

On page 117 of your October issue, you have a picture of a Jap torpedo plane which you called a *Kate*. The plane is actually a *Jill*. I'm not really a mistake hunter, but I couldn't pass up this opportunity.

For the chief differences between the *Kate* and *Jill*, I cite the Recognition Journal which lists the "*Jill's* more prominent nose cowling, taller fin and rudder, and longer, narrower tailplane. *Jill* has four feet less wing span and one foot more length. The wings are roughly the same shape but on the *Jill* the dihedral starts from the root. *Kate's* wing has a straight inboard section." The picture you published shows a plane with full dihedral wings.

M. E. BOYLSON, ARM S1/c

Purcell, Okla.

● You're right, Jack, it's a *Jill*.—ED.

HAIL, THE ATC!

Sirs:

I read with considerable interest the article "When Johnny Comes Flying Home" in the December issue of FLYING. Here are some facts it failed to consider:

With all due respect for the ability of airline pilots, the Army has any number of men who can show them tricks. ATC pilots are the best-trained transport flyers in the world today. They fly all sorts of weather, and they deliver their cargoes of passengers and equipment safely and with a degree of smoothness and proficiency that has yet to be equalled in any other organization.

ATC requirements are just as rigid as those of the CAA and the airlines—even more so in some respects. Training is just as complete and detailed as that which any domestic pilot has received. Army men have hundreds of hours in meteorology and in various other ground-school subjects. There are not many even of the co-pilots who do not have more than 100 hours Link time. And most of their regular flying time—hundreds of hours of it—is chalked up in the C-54 and the C-46, the very type planes the airlines expect to use after the war.

Sure, we expect to fly co-pilot for a while if we take jobs with the airlines. But two years of it just to master instrument let-downs, airline procedures, and other stuff we already know just doesn't make sense. It is a sadly warped comparison, this idea of an airline pilot sitting in his giant twin engine plane and an Army man flying his tiny little four-engined C-54—and doing it safely and in all sorts of more difficult conditions.

FLIGHT OFFICER J. B. BUSH

New Smyrna Beach, Fla.

ANZACS CAME LATE

Sirs:

In the article "Campaign By Air" which appeared in the October issue of FLYING, you state that "Instead of incurring needless losses there (speaking of Kolombangara) we invaded Vella Lavella, landing New Zealand troops and seizing the airfield."

I am a former member of the 58th U. S. Naval Construction Battalion that made the initial assault on this island. On August 15, 1943, we landed with an infantry outfit and a defense battalion of Marines. There was no airfield. But our battalion received high praise for building the one which Navy officers called "the finest airfield in the Southwest Pacific . . . though the hardest to construct." "Pappy" Boyington's Blacksheep Squadron was based there and the field did much toward making the Bougainville landings possible.

The New Zealand troops you mentioned weren't landed until late in September.

C. EDWARD GIDERS, EM2/c

Naval Hospital

Chelsea, Mass.

THE DUKE OF YALE

Sirs:

In the midst of a remarkably good issue of FLYING—the one for October—there is an error that I cannot let pass without protest. In the article on "The Fighters" there is a picture of three men, one of whom is Lieut. "Duke" Henning. The text says he once taught history at Harvard. Since I took a goodly amount of American History under "Duke" Henning in the classrooms of Yale I feel—as will all Yale men—that grave injury has been done.

ARTHUR D. DODGE, II

Biloxi, Miss.

WASP STILL STINGS

Sirs:

The author of "Requiem for the WASP" (FLYING for December) was mistaken in her repeated assertions that male pilots opposed the WASP organization because of jealousy or a fancied "superman" complex. The majority, if not all of the men realize that these fighting girls were motivated by a high sense of patriotism and that the original WASP's, the "oldtimers," got a dirty deal indeed. But, even so, it doesn't quite match the sort of treatment we received.

Miss Poole asks "where were the overage, experienced pilots in September, 1942, at the inception of the WAFS?" And her answer is partly right—"They were instructing in Army civilian contract

(Continued on page 144)

"Smith reporting back for his parachute, sir."

THE LIBRARY

AIRPORT ENGINEERING, by H. Oakley Sharp, G. Reed Shaw and John A. Dunlop; published by John Wiley & Sons, 440 Fourth Ave., New York, in 1944. 148 pages. Price $3.

For the undergraduate civil engineering student who studies the planning and design of airports, and for the city engineer who wants a fundamental treatment of this new aspect of his duties, "Airport Engineering" is a valuable book.

The writers, H. Oakley Sharp, Professor of Geodesy and Transportation Engineering of Rensselaer Polytechnic Institute, and G. Reed Shaw and John A. Dunlop, both assistant professors of the same subjects at the same school, have recognized that airport construction involves many design procedures which are common to other engineering tasks. But their book justifies the contention that there are enough special tasks and engineering methods involved to require a complete separate treatment.

Paving, of course, comes in for extensive and detailed discussion with reference to the loads to be expected on runways of future commercial airports. The book devotes chapters to soil stabilization, flexible-type pavements and rigid-type pavements, and the authors have included many excellent photographs as well as much research in this field.

In the all-important matter of drainage, the writers urge the engineer to stand up manfully to the non-technical board usually concerned with appropriations—to make sure that this invisible, non-esthetic factor of the good airport gets proper consideration. They devote 25 large and well-illustrated pages to drainage, attesting its importance.

The specific problems in layout and design are adequately covered—location of buildings, taxiways, turn-arounds and warming-up areas. While they pontificate, as textbook writers must, the authors point out that changes in the technical aspects of aviation are certain to affect the airport materially. Elevations and floor plans of typical administration buildings for large and small airports are included. There is generous use of charts and tabulated informational material which will make the book useful, not only as a textbook for the scores of engineering schools now considering airport design and construction, but also as a reference book in the office of the average city engineer.

CHARLES E. PLANCK
Civil Aeronautics Administration

THE AIR FORCES READER, edited by Norman Cerliste; published by Bobbs-Merrill, 468 Fourth Ave., New York, in 1944. 406 pages. Price $3.75.

Sixty-two previously published articles on the Army and Navy Air Forces have been carefully collected in Bobbs-Merrill's latest aviation publication to make one of the most all-inclusive volumes yet published on the part air power is playing in World War II.

Authors of note, such as John Steinbeck and Paul Gallico, are represented in the collections as are military and Naval officers and enlisted men who were widely known in the aviation fraternity as air writers before the war.

The publisher's own comment does not exaggerate the purpose of the book: "Selected to cover every phase of aerial training, every foreign theater in which air power has wielded its mighty strength, these articles present the whole picture of global war in the sky as fought by our Army, Navy and Marine flyers."

The report to the Secretary of War, made by Gen. H. H. Arnold, Commanding General of the Army Air Forces, covers the amazing growth of the AAF from Pearl Harbor to January, 1944.

Two articles which were originally written for FLYING are featured. They are "Paratroops," written by Lieut. Col. Louis E. Marie, USMC, and "Flight Nurse," an article written by this reviewer.

"The Air Forces Reader" is an historical document, worthy of a place in the library of every air force enthusiast.—
LIEUT. GEORGE MASON, AAF.

MEDITERRANEAN SWEEP, by Maj. Richard Thruelsen, A.C. and Lieut. Elliott Arnold, A.C.; published by Duell, Sloan and Pearce, Inc., 270 Madison Avenue, New York, in 1944. 278 pages. Price $3.00.

Mediterranean Sweep, a collection of true stories, highlights the humor, heroism and sacrifices of some of the men who participated in the decisive Mediterranean air campaign. This campaign started with the repulse of Rommel's drive across Egypt during the first few days of September, 1942, and ended 22 months later with the capture of Rome. Because of the importance of this major action, the authors have chosen vital subject matter in their decision to preserve some of its most memorable stories. Some are trivial, some significant, some comic, and others tragic—put together in chronological order they make highly interesting reading.
LYNN H. SLIFE.

Now go in there and give 'em hell!

SHORT VIEWS

ROCKET RESEARCH, by Constantin Paul Lent; published by Pen-Ink Publishing Company, 130 West 43rd Street, New York, in 1944. 102 pages. Price $5.

Written by an industrial designer who believes that the nation "most advanced in rocket research will conquer the world," this research handbook is filled with illustrations, formulas and tables helpful in rocket calculation and design.

INTRODUCTORY AERONAUTICS, by Clarence A. Hemmond, Jr., and Harry H. Gilbert; published by the Oxford Book Company, 222 Fourth Ave., New York, in 1944. 275 pages.

A noteworthy attempt to meet the requirements of a one-year basic elementary course in the principles of aviation, airplane mechanics, meteorology, and navigation.

AIR HERALDRY, by Carl Mann; published by Robert M. McBride and Company, 116 East 16th Street, New York, in 1944. 254 pages. Price $3.50.

Unique among war books, Air Heraldry presents more than 600 photographs of squadron insignia, along with historical notes and explanations.

All-star Production

Long before the B-29's bombed Japan, the Boeing Superfortress was faced with its first great challenge. This was in the battle of production . . . the problem of establishing one of the greatest manufacturing programs ever attempted.

Producing the Boeing-designed Superfortress in quantity is a colossal example of team-work involving people and plants all over America.

Completed B-29's are turned out by Boeing plants at Wichita, Kans., and Seattle-Renton, Wash., and by the Martin and Bell aircraft companies as well.

Major assemblies are built by Briggs, Cessna, Chrysler's De Soto Division, General Motors' Fisher Body Division, Goodyear Aircraft, Hudson, Murray and A. O. Smith.

The Superfortresses' huge engines are manufactured by Wright Aeronautical and by Chrysler's Dodge Division. Their 16½-foot Hamilton Standard propellers by United Aircraft and Nash Kelvinator.

Literally thousands of sub-contractors and suppliers, from small shops to large factories, supply sub-assemblies, parts and equipment.

To Boeing fell the task of co-ordinating this vast, nation-wide manufacturing organization. Its engineers furnished design and engineering data to the other companies involved, and laid down the tooling plans.

Boeing production specialists blazed new trails in planning, developed new facilities, processes and manufacturing procedures on a scale never before tried. They had to execute the program in terms of other manufacturers, *and in Boeing plants at the same time.* For Boeing's own eventual schedule is approximately 75% of all Superfortress production.

After Japan is defeated, this unique experience, and this same Boeing ingenuity in research, design, engineering and manufacture will be turned to peacetime aircraft. And you can know of any product . . . if it's "Built by Boeing" it's bound to be good.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the Carpenter's Bldg., Washington 1, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time.

LET'S SIMPLIFY MEDICAL EXAMS

MEDICOS of the Civil Aeronautics Administration have opposed all efforts to liberalize the requirements for private pilot certificates. It is this dogmatic obstinacy that compels AOPA to pin-point certain targets on the campaign for simplified regulations. And the first target is this business of medical standards for non-scheduled pilots.

Medical chiefs of the CAA have asked for *higher* medical requirements; AOPA asks for *lower* requirements. As a matter of fact, AOPA doubts the necessity of *any* special examination by a CAA appointed examiner. A pilot's personal physician is sufficiently qualified for the job of checking eyes and heart, the two important elements in a flying exam.

Government-appointed medics, who have joined forces in an Aero Medical Association, claim that they have something the family physician lacks when it comes to passing a candidate medically for a pilot's ticket.

We are curious to know exactly what that "something" is. Is it some special ability or is it some new type of equipment used in examining pilots? Information thus far assembled discredits the "special ability" idea. Records indicate that almost any physician can become a CAA medical examiner provided he buys a bunch of "Rube Goldberg" gadgets.

Since no special ability is required to use a stethoscope or to determine blood pressure or hereditary diseases, we may conclude that the family doctor is well prepared to do such jobs.

This leaves the matter of eyesight and so-called physical "disqualifications." The eye exam consists of (1) determining depth perception, (2) visual acuity, (3) color blindness, (4) structural defects, astigmatism, etc.

To determine relative depth perception a gadget has been designed consisting of one fixed black peg and another peg which is moved fore and aft by the manipulation of two strings. Visual acuity is determined by reading tests on charts and by use of another gadget which all eye doctors and most family physicians either own or have access to. Color blindness, or we should say *relative* color blindness, is easily determined by sorting colored yarn and reading numerals in color test books, equipment in the possession of most physicians.

And the family doctor can easily detect the presence of structural defects and their effect on the sight of the individual.

But beyond this logical contention that special Government doctors are not necessary (and far too expensive), AOPA questions the *present physical standards*. CAA wants to raise these standards even higher. The only apparent reason seems to be the desire to build a larger medical unit for CAA.

AOPA has assembled medical reports which completely refute the arguments thus far advanced to justify retention of present CAA physical standards. These reports are being readied by competent medical authorities and represent many months of careful medical research. Their findings already indicate that strong arguments supported by more than mere opinion will be necessary to justify present CAA standards. One significant bit of research points to accident records of the Civil Aeronautics Board which fail to reveal a single accident that has been caused by physical deficiencies.

That fact alone makes it difficult to account for the attempt of CAA medics to raise the standards. The tendency of certain members of the CAA medical headquarters to assume the role of flight surgeon officers could mean that they dream of taking over Army flight surgeons at the close of the war and thus build an even greater dynasty at the expense of private flying.

The medical reports, mentioned above, aim at refuting CAA's contentions. When completed they will be properly presented to CAA's Administrator. The industry and non-scheduled pilots have declared "open season" on restrictive air regulations. The medical requirements are number one target and the support of all pilots is enlisted for this campaign.

NEW AIR RULES PROPOSED

The Civil Aeronautics Board has recently submitted to the industry drafts of newly proposed Parts 20, 43, and 60 of the Civil Air Regulations for further comment before final action is taken. Original proposed revisions have been circulated to AOPA members in the past and we urge all AOPA pilots to obtain a copy of the latest revisions which will be sent to them upon request from AOPA National Service Office, 1003 K Street, N. W., Washington 1, D. C. A postal card will do.

BROKEN PROMISES

We recently reviewed the speeches of the Assistant Secretary of Commerce for Air and also those of the Administrator of Civil Aeronautics in which they promise simplified regulations, airport assistance for *small* airports, and many other benefits to flying. But many of these promises were merely "announcements" of policy. They made very good reading and we believe for the most part that they were sincere pronouncements of intended action. But what has happened? The CAA administrator calls for simplified regulations, and announces that he will bring them about, but the CAA staff seems to be in direct opposition to any such simplification.

This is no secret. The whole industry knows that the lower echelons of CAA are openly obstructing adoption of simplified regulations.

Recently CAA acquired a new administrator. For that reason AOPA has postponed direct action until he has had the opportunity of bringing about the organizational revamping. The time will soon come, however, for a showdown. The future of the industry depends upon getting simplified regulations. CAA must act as an assisting organization rather than a police force or as obstructionists.

Many individuals in the CAA and CAB do recognize this problem and are trying to bring about progressive changes. To these hard-working friends AOPA extends its encouragement and full aid. The task at hand must be accomplished by mutual understanding and co-operation. It must not be delayed because of CAA organizational disputes over problems of intra-office jurisdiction or by over-zealous legal staffs who desire to see a complete legal treatise in every regulation.

LICENSES FOR MILITARY PILOTS

Members of the armed forces of the United States who have served on solo flying status for a period of six consecutive months and who have served in the armed forces within the preceding 12 months may now apply for civil pilot licenses commensurate to the military pilot rating held.

Such an applicant is required to pass a written examination on Parts 20 (Pilot Certificates) and 60 (Air Traffic Rules) of the Civil Air Regulations. He must submit documentary evidence showing that he is a member of the armed forces or that he has been honorably discharged or returned to inactive status, and that he is, or was, a rated military pilot. His total solo flying time must also be verified.

Type, class, and horsepower ratings will be issued in connection with such pilot certificates or in connection with a private or commercial pilot certificate held by the applicant if he presents reliable documentary evidence showing that within the preceding 12 months he has had at least 10 hours of flying time during which he was sole manipulator of the controls of aircraft of the type, class, and horsepower for which a rating is sought. END

Hitchhiking to Heaven

(Continued from page 47)

was known in Victorian days as a "delicate condition." Engineers again went through official channels for more sheep.

Family-minded sheep were not their only problems. Inexplicable things happened. On several attempts the pickup plane apparently made perfect contacts but the pickups weren't completed. Eye witnesses argued and argued. It took high-speed photography to show exactly what had happened.

Equipment used today in pickups is basically similar to that which bore Lieutenant Doster aloft, but refinements have been made in practically every feature. Data from recording instruments gave project engineers invaluable assistance in determining just where to change. They found, for instance, there was a strange difference in the pickup after the proportion of the various nylon ropes had been changed.

Ground equipment is quite simple. Two light poles are set up like goal posts. A nylon rope stretching from pole top to pole top holds aloft the nylon loop which permits the low-flying pickup plane to make contact. The loop is attached by a nylon rope to the harness worn by the pickup subject. This equipment may be dropped by parachute and easily set up by one man.

Inside the plane, the pickup mechanism consists of a reel wound with 185 feet of nylon rope. At the rope's end is a hook held by a release at the free end of a long wooden pole which hangs 10 feet below and to the rear of the landing gear.

Immediately upon contact with the pickup subject, the reel begins automatically paying out rope with automatic delayed action brakes gradually reducing the rate of payout. About 80 to 100 feet of rope will have been paid out by the time the brakes are on full and the subject's body attains the speed of the plane.

At that point the pickup operator inside the plane presses a button starting the electric reeling motor. Like a giant fish, the subject's body, planing behind, is reeled smoothly into the door.

The subject awaiting pickup reclines with the back of his head pointing toward the poles and the loop. A broad web belt pulls his legs tightly to his body in the fetal position. Doster wore his harness so snug he had to be strapped into it but latest tests indicate the harness, actually a standard parachute harness with rearranged straps, may be worn loosely enough for self-attachment. Nor is it necessary, like Doster, to wear special clothing to cushion shock. There just isn't that much shock.

A pick-up's body does not drag along the ground but gains altitude smoothly after an initial vertical ascent of about eight inches, planing upward like a glider. The plane has begun a steep climb immediately upon contact, mushing along just above stalling speed. Reeling of the nylon rope allows the body to approach the speed of the plane smoothly and it takes only two minutes and 45 seconds for a subject to get inside the plane.

Lieut. Norman S. Benedict, the pilot, who picked up the last three hitchhikers, has made 75 pickups. "It's strange," he relates, "but with cargo containers or sheep you get a definite impression of having picked up something solid. The pickup of a human, however, is soft as a marshmallow.

"A human's body is more streamlined and flexible than anything else we have picked up. The first time I picked up a human it scared me half to death. I thought something had gone wrong because I didn't receive the same jolts."

AAF engineers thought of every contingency. Safety knives run the length of the fixed landing gear and cut the loop if the plane comes in too low, as happened in the second and third pickups. Sergeant Conway was flipped over backwards but was uninjured. Captain Lee-Warner, however, didn't even budge as the loop was cut.

The human pickup is limited at present to lightweight, highly maneuverable airplanes, but experiments are under way to develop techniques for using the equipment with high-speed combat planes. Used thus far were the Stinson *Reliant* and with more recent pickups the Noorduyn *Norseman*. Both planes are single-engined monoplanes.

There is less "G," or acceleration, to the human pickup than if you jumped off a kitchen chair stiff-legged. Such a jump would give you about an eight-G jolt, while the peak of the human pickup at 130 m.p.h. indicated air speed is seven Gs.

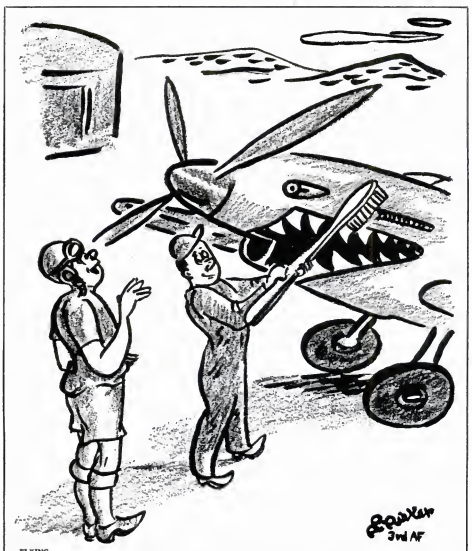
The peak lasts for about one to one and one-half seconds, after which the braking system drops the G to 1.7. As soon as the subject's body reaches the speed of the towing plane, the G drops to 1.3.

Engineering data indicates such pickups may now be made at speeds of 158 m.p.h. or faster. Aero-medical laboratory experiments show that for brief periods the human body can stand about 12 G's without ill effects. Picking up at 158 m.p.h. gives the subject only 10 Gs—and that for such a brief span he does not black out as a result of blood rushing from his head. The blood simply doesn't have time.

Seldom has aviation history been made by a more light-hearted, nonchalant crew.

Captain Lee-Warner actually tried to light a cigarette on his trip aloft. Corporal Stiakatis unsnapped his leg straps in an instant and waved energetically to the plane crew as he was reeled in. Sergeant Conway slid into the plane and chirped:

"Boy, that's jerking a jerk." END



"Be sure and get in around the molars."

Shakedown Cruise

(Continued from page 62)

the hangar deck on one of the three elevators. Here, every needed kind of maintenance work is done. Today, it was nothing but routine checks by engine and plane crews. Off the hangar deck are the propeller shop, aviation machine shop, instrument shop, parachute loft, radio repair shops, armories, while others are ready with everything from rows of spare belly tanks to a supply of extra plexiglas. Below decks are more activities: crew's mess, sick bay and dental office, print shop, power generators, photo lab, torpedo shops, ship's secretary. Everything hums in preparation for the following day, for which there is a packed schedule.

What goes on in a typical carrier day? The Air Department, at times, seems like a separate part of the ship; it is for the Air Department, which includes the air group (attached squadrons), that the carrier exists and operates at all. So it is only natural that the rest of the crew should have a peculiar if sometimes perplexed fondness for Air Department members. They call them "Those Goddamned airedales."

The program for the day will include designated landings, catapultings, deck take-offs, planes sent to hangar deck for check or overhaul. It may include special problems, such as making an aerial mosaic of an island, which will give the photo-lab crew a real taste of combat conditions. It may provide for special training (even during operations synthetic training devices ranging from slot-machine affairs to power turrets are never idle) or a series of conferences on landings, with minor faults criticized or techniques discussed. Whenever weather permits, it will include a gruelling day-long session, perhaps a night-landing session besides.

When crewmembers speak of "those airedales," in combat or not, they mean it respectfully.

One way to better understand the air department of a carrier is to examine its organization. This varies from carrier to carrier but the general setup will find five major divisions in the organization of the airdales:

The air group—fighter, dive bomber and torpedo bomber squadrons.

Flight deck operations.

Hangar deck operations (including shops).

Air intelligence (aerology, photo-lab and photo interpretation, etc.).

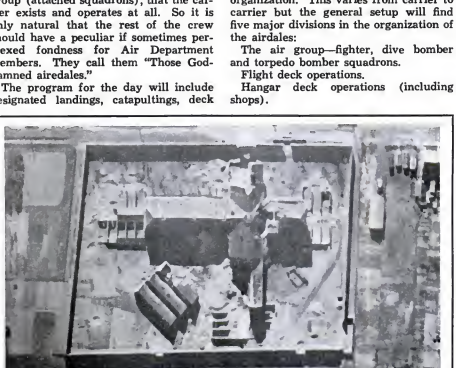
Administration.

In everything connected with a carrier, air operations center in the air department. The antiaircraft artillery has the task of finally beating off enemy plane attacks. The planes themselves, especially fighters, keep Jap planes at a distance and the antiaircraft of escort vessels knocks down *Bettys* and *Vals* miles away from the carriers. Those planes that get through the protecting screen meet a fire from batteries of five-inch guns, 40-mm. Bofors, 20-mm. guns and .50-caliber machine guns. There are three stages of combat readiness which affect ship, men and gun crews. When condition X (spoken of as condition "Xray") is set, the ship is in an operation zone and certain water tight doors are closed and other formalized precautions relating to fire fighting and damage control are taken. When condition Y (referred to as "Yoke") is set, an additional series of precautionary steps is taken which includes the automatic closing of all doors marked Y. When general quarters sounds, the ship automatically goes into condition Z (or "Zebra") in which all Z doors are closed and moving from point to point inside the ship becomes almost impossible. During battle quarters every man is at the assigned position (mess boys for instance man antiaircraft machine posts).

One of the tensest experiences aboard a carrier is general quarters at night. No lights show. Every man must be at his gun or assigned battle post within a few minutes of the sounding of "general quarters." The ship is ominously quiet as it drives through the night's blackness—quiet, that is, until firing starts. Star shells bursting high in the air float down over the water, illuminating the target area and casting a baleful green-yellow light over the ship.

Night on a carrier is always dramatic. In the small hours of the morning on the almost deserted hangar-deck a few mechanics working on the engines emphasize the quietness of the rest of the ship. Or you may go through a light trap (where opening door automatically turns out the lights inside until the door is closed) to the photo-lab where prints are being made of aerial photographs taken earlier in the day, where even motion pictures of landings have already been developed and the film is being dried by spinning it around on a giant drum.

One of the most interesting night scenes aboard a carrier is flight quarters with the arrester gear and barrier men at their post on the catwalks and only a few special landing lights showing. If one stands in the island and looks aft down the flight deck, almost the only thing visible besides the dark shadow of the ship herself is a tiny purplish glow—a fluorescent light. To the pilot coming in from the landing circle this special fluorescent light shines upon the landing signal officer wearing a fluorescent yellow and red suit and waving fluorescent yellow signal paddles. This bright spot of glare-free glow is the only guide to the landing pilot. Etched against the dark it is also a symbol of vast technological achievement —a great aircraft carrier. END



STRANGE MISSION

WORD reached British Intelligence that 100 French patriots in the prison at Amiens were to be executed shortly by the Gestapo. Three squadrons of RAF *Mosquitoes* were chosen for the job of bombing openings in the prison building and in the wall, 20 feet high and three feet thick, surrounding the prison. The RAF was their last slim hope.

On February 18 the *Mosquitoes* hit their target. How accurate and effective a job they did can be seen in the photographs here. The attack was made "on the deck." About 70 Frenchmen escaped through the blasted wall (right). Group Capt. P. C. Pickard, pilot who starred in "Target for Tonight," was killed during this operation.

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Battle of the Philippines

(Continued from page 25)

And since the Japanese had not conceived of the possibility of a fleet going to sea and being able to stay at sea for a long period of time, they worked on the premise that any attacks we might make would be based on the up-to-then inevitable navy practice of returning to the main base after each fight in order to refit and resupply the vessels engaged.

In other words, they thought that like the Union Army until Grant took command, there would be a long pause after each battle while the next battle was prepared. They have now found out that, just as Grant's strategy was to start in fighting and never stop no matter what happened, they are face-to-face with a fleet of battleships and an air force which can do the same thing at sea. This is the first time in history that this has been true.

Nor did the Japanese have any idea that we would by-pass any of their fortified islands. Their strategical picture was that the mass of the Japanese fleet would sit quietly at the center of a series of island sea defenses, each one of which, because of its garrison of ground troops and land-based aviation, would present a serious problem for us to capture. As each fell we would have to attack another a little bit closer to Japan.

Had we followed this procedure, the Japanese would not have found it too difficult to supply their islands because their supply line would always have been inside the outer line of defense against which we were hammering. Even if we were slowly contracting these defenses, we would always have been on the outside of them.

Aviation attacks on sea lines of communication are always more difficult than aviation attacks on land lines of communication. Ships in the vast Pacific Ocean do not have to stick to definite routes, whereas land lines of communication, consisting of railways, roads, rivers and canals are easily watched and attacked when used.

Our bold strategy of by-passing those Japanese-held islands which we did not consider essential to our advance toward the Philippines accomplished two things. First, it enabled us to reach the Philippines in a relatively short time by comparison with the time necessary had we followed the Japanese idea of what we would do. Second, it cut off from their supplies the Japanese outlying garrisons which we had by-passed.

One of the greatest difficulties in fighting on land since armies grew far beyond the size where any general could see and control them from the back of a horse has been what the Germans call the "fog of war." The fog of war is simply the inability to know exactly where your enemy is and what he is doing. Without this knowledge it is extremely difficult to plan strategical operations. The fog of war at sea has always been more difficult to dispel because of the immense expanse of the seas and the smallness of a fleet moving on their surfaces. A fleet can move in any direction whereas land forces move on well-marked roads and railways. Napoleon took an army from France to Egypt, stopping off on the way to capture Malta, while Nelson with his fleet dashed around the Mediterranean vainly hunting for him.

Thanks to aviation, we could clear up the fog of war while keeping the Japanese groping around within it. This has given us the power to make surprise attacks, with the Japanese never knowing where or when we are going to attack them.

For many years the Army and Navy war colleges worked on plans to reinforce the Philippines before the Japanese could take them and, failing that, to fight our way through the Japanese-held Marshall, Caroline and Ladrone islands, stretching over 2,800 of the 5,300 miles between Hawaii and the San Bernardino Straits. It was known that, despite the terms of the mandate issued by the League of Nations to Japan, she was fortifying these islands and building navy bases—for what use we have now seen.

No matter how the problem was attacked in the war colleges, it always resulted in a long dreary period with heavy losses from island-hopping deemed necessary.

The development of new strategy and tactics, however, thanks to the tremendous growth of our Navy aviation, drastically changed this problem. Added to this tremendous growth was the understanding that aviation alone could not successfully face a surface fleet whose backbone is battleships and which is supported by carrier-borne aviation. Both sides in the battleships vs. aviation controversy were forced to the conclusion that in order to operate successfully in the face of an enemy at sea each had to have the other.

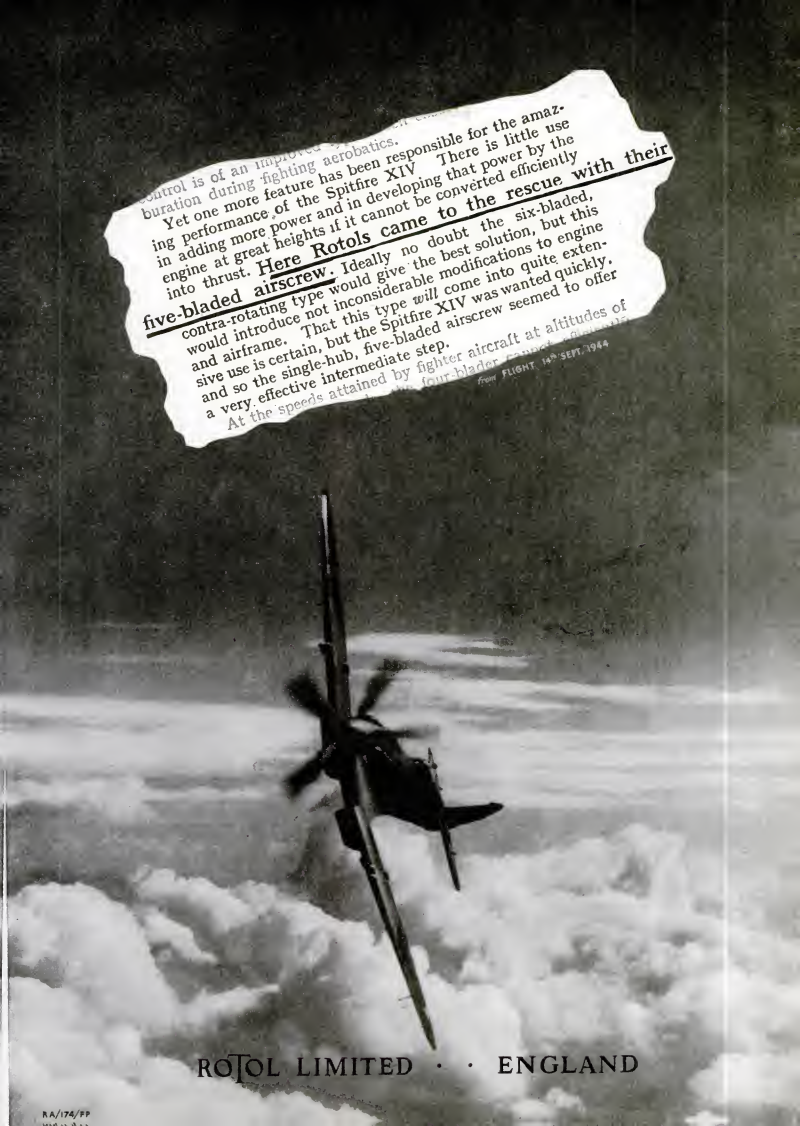
The advance of Admiral Nimitz and General MacArthur finally brought us to the point where we were holding islands

COLLAPSIBLE CHOCK

Mechanic places chock in front of wheel. Note position of side handle.

Chock collapsed. Now note that side handle has been pulled up, turning the loop into a position where the pressure of plane collapses chock.

A LIGHT metal collapsible chock which can be released by the pilot without getting out of the plane has been designed and built at the AAF flying school at Enid, Okla. The inventor is a civilian mechanic, Earl C. Gregg, employed by the 29th Sub-Depot aircraft maintenance hangar at the school. The chock consists of hollow steel tubing, a small amount of solid steel shafting, and a boiler plate apron. It can be collapsed by jerking a chain attached to the outer end of the solid steel loop handle at the rear of the chock. The loop retains the chock structure in a triangular position by locking the pin end securely in place. When the handle is pulled, the loop is turned until its open side faces forward and the pressure of the plane forces the entire chock flat. The chock is easily reset, permits one-man warmup.


control is of an
buration during fighting aerobatics.
Yet one more feature has been responsible for the amaz-
ing performance of the Spitfire XIV. There is little use
in adding more power and in developing that power by the
engine at great heights if it cannot be converted efficiently
into thrust. Here Rotols came to the rescue with their
five-bladed airscrew. Ideally no doubt the six-bladed,
contra-rotating type would give the best solution, but this
would introduce not inconsiderable modifications to engine
and airframe. That this type will come into quite exten-
sive use is certain, but the Spitfire XIV was wanted quickly,
and so the single-hub, five-bladed step.
a very effective intermediate
At the speeds attained by fighter aircraft at altitudes of
four-blader
from FLIGHT, 14th SEPT. 1944
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both east and southeast of the Philippines and Formosa. At this point the question was where we would attack. We had to obtain a base large enough to hold the troops, the supplies, the air fields and the naval base necessary to land successfully either on the coast of China or to attack Japan proper. Our possession of Saipan, Tinian and Guam gave us the opportunity to proceed north via the Bonin Islands to attack Japan itself or west to attack either Formosa or Luzon. Our capture of several of the Palau Islands and of Morotai gave us airfields to attack Mindanao in the Philippines.

The Japanese had no way of knowing. From Mindanao to Japan proper is as many degrees of latitude as from the Panama canal to San Francisco. This was a tremendous extent of land and sea for the Japanese fleet and aviation to protect from surprise.

The decision as to the place of our attack was made when the President visited Hawaii with Admirals Leahy and King and went over the situation with Admiral Nimitz, whose headquarters is in Hawaii, and General MacArthur, who had flown in from the Southwest Pacific.

A direct attack on Japan, or an attempt to land immediately in China, was probably eliminated because not enough troops were available. Formosa was probably eliminated because it was entirely too mountainous to allow us to build the number of airfields and billet the number of troops we must have for a real invasion of either Japan or China. In addition, there is no first class harbor big enough to base our fleet in Formosa. The only large harbor is in one of the Pescadores, the little group of islands between Formosa and the China Coast, which was probably the base for the Japanese expeditionary force which attacked the Philippines.

While on a secret mission for Gen. Leonard Wood, then chief of staff of the U.S. Army in 1911, this writer visited all the harbors of Formosa and managed to get to the Pescadores Islands though foreigners were forbidden to go there. At this time the possibility of war with Japan was a much-discussed subject in our army. Among other things, Gen. Leonard Wood wanted to know whether there was a Japanese expeditionary force in the Pescadores or Formosa.

Mindanao and Luzon were not chosen, probably because they were the two places in the Philippines where the Japanese expectpd us to land.

Aviation was used to its fullest to create the fog of war for the Japanese, and the flexibility of that aviation was used to keep them confused as to the point of attack.

The Ryuku Islands between Japan proper and Formosa were attacked by our Navy aviation October 9. Various points throughout the Philippine Islands were attacked and finally, on October 19 —after 10 days of confusing the Japanese by aerial feints—we landed on Leyte. That the Japanese were completely surprised is shown by the fact that no naval force was there to oppose this landing, that the enemy was unable to concentrate his ground-based air in sufficient strength to damage seriously our ships and troops during the landing, and that there was only one Japanese division in Leyte to oppose us.

Thus, thanks to our dominance in the air and our dominance in battleships to protect our carriers, we were able to surprise the Japanese and land successfully in the Philippines with relatively small loss. Once ashore the single Japanese division opposing us had no chance of preventing our landing being expanded into a real invasion of Leyte and an occupation of Samar.

It was certain, however, that the Japanese would make an effort by land, sea and air to cut off our landing force by destroying its sea communications and then to defeat it by bringing in troops from the other Philippine Islands.

On October 23 our carrier-based planes and submarines reported two Japanese forces of battleships, cruisers and destroyers approaching from the west. Neither of these fleets had carriers—apparently intending to get their aerial protection and attack strength from land-based planes in the Philippines.

The northermost fleet was west of Mindoro and consisted of five battleships, 10 heavy cruisers, one light cruiser and 13 destroyers. This force came around the southern tip of Mindoro and entered the Sibuyan Sea from which it made its way through the San Bernardino Straits between Luzon and Samar into the Pacific Ocean and thence headed south along the east coast of Samar toward our landing area on Leyte.

Apparently this fleet intended to join in the waters east of Leyte with the southern Japanese fleet first picked up by our aviation at the entrance of the Mindanao Sea between Negros and Mindanao. This was also a formidable force but also lacked air carriers. It consisted of two battleships, two heavy cruisers, two light cruisers and 13 destroyers. This fleet entered the Surigao Straits between Leyte and Mindanao heading for the waters east of Leyte apparently with the intention of uniting with the northern force coming down from the east coast of Samar.

All information brought in by our planes and submarines indicated that these two fleets once joined in the waters east of Leyte intended to destroy all American transports, airplane carriers and warships found there.

Japanese success not only would have cut off General MacArthur's food and ammunition supplies but would also have

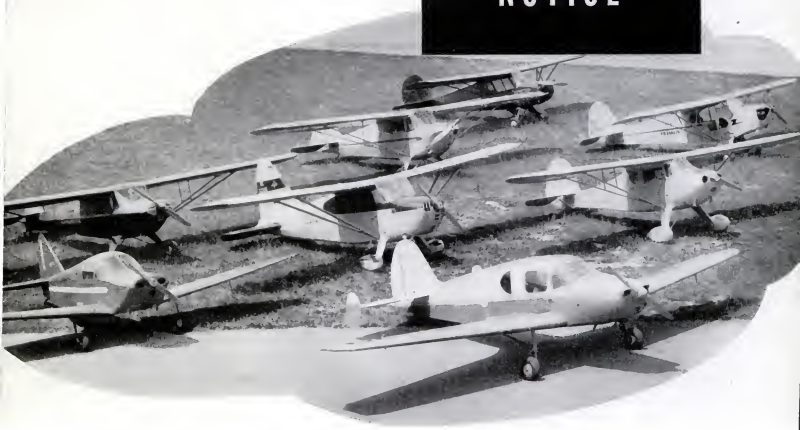
THE NEW STRATOLINER

AFTER 2½ years of military transport flying, the Boeing *Stratoliners* are going back into commercial service on TWA. The name *Stratoliner*, however, now is a misnomer, as the cabin supercharging equipment has been removed.

As this was written, the last of the five Boeings was in the final stages of rebuilding at the Boeing factory. The old wings have been replaced with *Flying Fortress* wings, the horizontal tail surfaces have been moved back three feet, the new engines deliver 1,200 h.p. each. Now a 38-passenger plane, the new *Stratoliner* cruises at 200 m.p.h. at 10,000 feet. Payload now is over 9,000 pounds, range over 1,000 miles. Dimensions are the same as in the past: span, 107 ft. 3 in.; length, 74 ft. 4 in.; height, 21 ft. 1 in. There are five crew members.

Other modifications include the installation of *Flying Fortress* landing gear, new propellers. The five Boeings will give TWA the equivalent of nine Douglas DC-3's. Rebuilding cost was $385,000 per airplane.

IMPORTANT NOTICE



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deprived his troops of all aviation support because he was still primarily dependent upon carrier-based planes for reconnaissance, regulation of artillery fire and direct attack on the enemy's ground troops. It would also have deprived him of the support of the guns of any of our warships being used to reinforce his artillery fire.

But instead of having returned to some distant base for renewing their fuel, ammunition and supplies, as the Japanese undoubtedly had expected, our warships, thanks to the Pacific Fleet Service Force, were waiting to attack the Japanese. Our forces were disposed as follows:

A carrier task force of the Third Fleet under Admiral Halsey was in the waters north of Samar. It consisted of carriers, fast battleships, cruisers and destroyers. A battleship-cruiser force of the Seventh Fleet under Admiral Kinkaid was in the waters south of Samar and close to Leyte. Farther out and forming a semicircle southeast of Samar and east of Leyte beachhead were three escort carrier groups.

These two onrushing Japanese fleets were under constant aerial attack both from the carriers of the Third Fleet and the escort carriers of the Seventh Fleet throughout their approach. To protect their ships, the Japanese sent land-based planes off their Philippine airfields and at least 150 were shot down, though some got through to sink the light carrier *Princeton*. Meanwhile the two Jap fleets continued to come on.

At this juncture a land-based search plane spotted a third Japanese fleet heading for the battle area. This was a carrier force, consisting of one aircraft carrier, three light aircraft carriers, two battleships of the *Ise* class with flight decks aft, five cruisers and 10 destroyers. This fleet was first discovered east of the straits between Luzon and Formosa heading south. Whether it was so far away from the other two Japanese forces because of bad timing and poor liaison or whether the Japanese admiral thought the main American fleet had retired east to seek its base and therefore there was no danger to the other two fleets is not known.

The Jap's southermost fleet coming through Surigao Strait reached the battle area first in the early morning darkness of October 24. They were met at the mouth of the strait by squadrons of PT boats lying in ambush. The Jap ships continued to come on and U. S. destroyers hit them next with torpedoes. Then at the very mouth of the strait they encountered the full firepower of the Seventh Fleet's heavy ships, including five modernized battleships which had been damaged at Pearl Harbor. The onrushing Japs faltered, turned back the way they had come. Their force was heavily damaged and the two battleships definitely sunk were from this fleet.

Admiral Halsey, in command of the Third Fleet, now had two choices: to turn toward the carrier fleet coming down from Japan, or toward the central Japanese fleet heading for the San Bernardino Straits. This fleet had been attacked by U. S. carrier-based *Helldivers, Hellcats* and *Avengers* and airmen reported that it had turned back. Therefore Halsey sent his Third Fleet after the northern Japanese carrier force.

There was little air opposition. Evidently the Japanese planes after attacking U. S. fleet units the day before had returned to Philippine land bases for refueling and bombing-up. They arrived too late and at least three of their carriers were sunk, two by air action and one by cruiser gunfire. Both of the battleship-carriers were also damaged, and the Japanese fleet turned back toward Japan.

Now the most critical point of the battle developed for the American warships. The heavy Japanese force coming through the Sibuyan Sea and which had been reported as turning away turned again and came rushing through the San Bernardino Straits. Admiral Halsey got a call for help from Admiral Kinkaid and his Seventh Fleet. The three escort carrier groups close in to Leyte were in a particularly vulnerable position. The Jap heavy force came roaring through the narrow straits before dawn—and before the escort carriers could get their planes off. The Jap ships had far more speed than the jeep carriers. Their heavier guns far outranged the carriers' five-inchers. The carriers did the best they could, firing over their sterns as they fled.

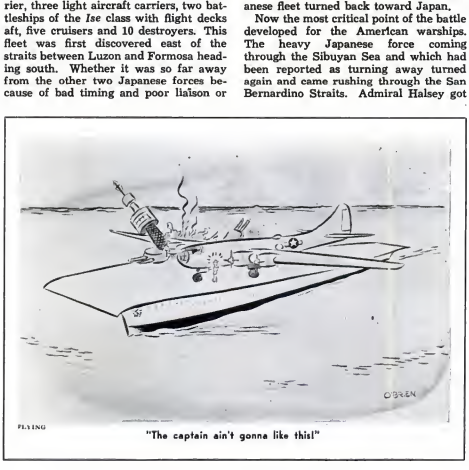
At sunup they got their planes off to strafe and bomb the attackers. Two destroyers and a destroyer escort bravely covered their retreat, but were soon sunk. Two jeep carriers also were sunk. Meanwhile, Admiral Halsey's fleet came boring southward to the rescue and to protect the shipping at Leyte. The Jap battle force continued on for a while—under aerial pounding—but at last, faced with the danger of being pinched off by Admiral Halsey's fleet from the north and Admiral Kinkaid's fleet, it turned and fled back into San Bernardino Strait.

This combined air-sea battle cost the Japanese heavily. At least two battleships, four carriers, six heavy cruisers, two light cruisers and an undetermined number of destroyers were sunk; another battleship, five cruisers and seven destroyers were severely damaged and six battleships, five cruisers and 10 destroyers were damaged.

The Japanese strategical plan is not yet clear. Unless they had the idea that our fleet with its air force would have to return to base after landing MacArthur's troops, they committed one of the oldest and worst strategical mistakes—dividing their forces in the face of an enemy. This is the cardinal idea of the amateur strategist. We see it constantly in newspaper and magazine articles which have arrows pointing to the routes of imaginary armed forces attacking the enemy from every direction. Napoleon's success was due to the fact that his enemies were always attacking him from a number of directions instead of concentrating their superior forces before meeting him in battle. Generally, with a smaller force, he would quickly move to attack one of these columns weaker than his own and defeat it before the other could come to its help.

Nelson's successes were due to the same principle. Napoleon attempted to concentrate the fleets of the continental nations. The British fleet was stronger than any one continental fleet but not as strong as all of them united. Nelson attacked them before they could unite. He sailed into Copenhagen Harbor and destroyed the Danish fleet before it could even put to sea and unite with the Spanish and French fleets. This so discouraged the Russians that they gave up plans to join their fleet in the common campaign against Nelson, who then destroyed the French and Spanish fleets in the Battle of Trafalgar.

By attacking in three widely separated forces, the Japanese were defeated in the same manner. Insofar as surface fleets are concerned there is nothing new in this. But in concentrating our air power on the enemy's air and warships, we achieved a perfect example of the value



FLYING "The captain ain't gonna like this!"

ONLY THOSE THUNDERBOLTS

COULD HAVE SAVED OUR BACON THIS MORNING!

"You all know how bad A-2 needs pictures for the big "blitz" they're planning... The C.O. told us to get 'em ...and he don't mean maybe... It was another job of sweating it out, and brothers did we sweat... the flak looked like a solid wall and about the time we managed to sneak through and get a couple of swell takes, things began to happen... A flock of those one-o-nines that Heinie's been saving, took us on as their personal meat... my port number two quit cold... starboard number one started smoking... our navigator copped a packet, the intercom went... then, just as I was begining to wonder what a shor'nuff pair o' wings would feel like, assorted hell broke out among Schickelgruber's spiteful lads... One burst into flame off my port wing, a gent making a head-on run disintegrated ... and by the time I limped around and headed for home, two more Jerrys were spinning down and the rest of the visiting firemen hightailed away from there... Believe me, chums, I was between a gulp and a prayer when two *P47's, who'd apparently been the total rescue squad, lined up over our tail, proceeded to wet nurse us home, and, as though it were just another routine chore, flipped around and went calmly back to the wars."

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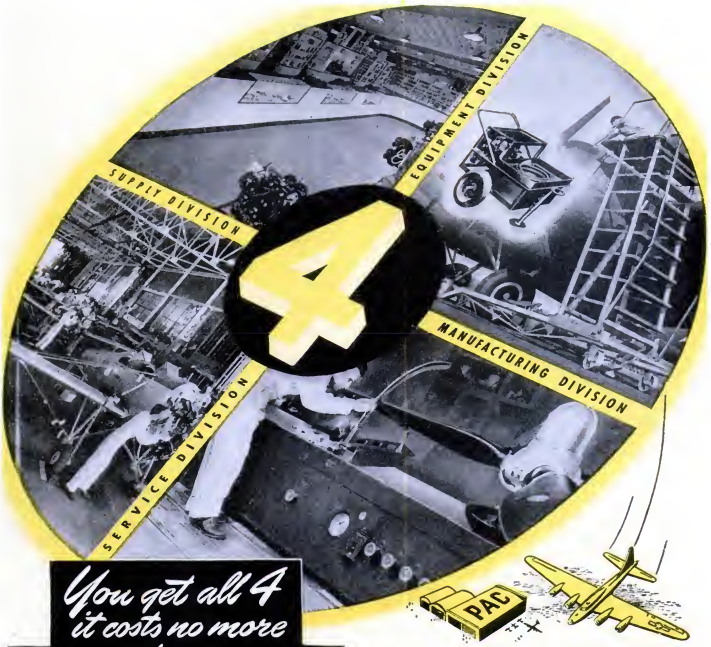

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GLENDALE	*Executive Offices, 409 No. Brand Blvd.*
GLENDALE	*6265 San Fernando Rd.*
OAKLAND	*Oakland Airport*
SAN DIEGO	*544 7th Avenue*
KANSAS CITY	*1628 McGee Street*

of concentrating all means of fire on the target. None of our airpower was wasted attacking Japanese industrial installations long distances from the scene of battle as is the case habitually when our ground troops are in battle in Europe.

Present reports seem to indicate that the Japanese scattered their air power. They have been in the Philippines two and one-half years. They have built many airfields throughout the islands. Therefore they had the opportunity to concentrate a considerable amount of land-based aviation against our fleet. But apparently they failed to do so. It appears that they were caught unprepared in the same way that our aviation was caught unprepared on the ground in most cases, when the Japanese aviation first attacked us in the Philippines. A further dissipation of Japanese air strength was caused by their scattering it among three separate forces rather than concentrating it against us.

This Philippines battle was the first time in this war—and therefore since the modern development of aviation — in which two modern fleets each with its own aviation fought a decisive battle.

The battle was decisive because it meant that MacArthur was not cut off from supplies and reinforcements. We can build up his force to the strength necessary to capture Luzon and establish there a large base for the invasion of either China or Japan in the same way that we used Britain to prepare for the invasion of France.

The influence of aviation upon naval tactics is shown by the great change in the fleet formation from the one habitually used in the maneuvers prior to the outbreak of this war.

The old formation was first a screen of destroyers backed up by cruisers. Then came the battleships and well to the rear of them the airplane carriers.

With our present method, the carriers are put well to the front so that their planes can be brought into action more quickly and will not have to fly such long distances. This lengthens the time they can be in action. The rest of the fleet is so placed that the carriers will always have plenty of protection from all types of enemy attack by air, submarine and by battleships and heavy cruisers. The air is no longer auxiliary to the battleships. On the other hand, the more fighting at sea we have done, the more it has been shown that the carriers are helpless without the protection of the big gunned ships. Today it is the battleship with the carrier and the carrier with the battleship which does the fighting, while the submarines, the destroyers and the cruisers are used to protect both from similar enemy ships.

From such reports as we have received to the present, the campaign of many weary months on the Pacific is an example of the correct use to the fullest extent of triphibious operations against an enemy. The Philippines invasion was roughly six months after the triphibious operation which carried the American and British forces from Britain across the English Channel.

A contrast between these two triphibious operations, both successful, serves to emphasize the excellence of the strategic and tactical operations which put us back in the Philippines. The difficulties to be overcome, both strategically and tactically, in the Pacific campaign were far greater than those successfully met in the invasion of France.

In each of these campaigns there were three problems to be solved: (1) getting there, (2) landing and staying landed, and (3) expanding the landing to a successful invasion.

In invading France we had only to get from Britain across the British Channel, whereas in the Pacific we had to get from Hawaii or Australia to Leyte—50 to 100 miles as against thousands.

The landing and staying landed in France could be supported by the American and British air supremacy land-based on England. The air used in the Philippine attack had to be based on carriers protected by a large warship force.

Once landed in France no further triphibious operations were necessary because we were on the same continent with Germany. On the other hand, once we have secured the Island of Leyte we will still have to attack Luzon by another triphibious operation before we can secure a large enough base for our land, sea and air forces from which to carry out the invasion of Japan or of China—whichever is decided upon. In other words, when we get to Luzon we will be roughly in the same position as we occupied when we were in England and prepared for the invasion of France.

No German naval forces of consequence could be brought to bear on our invasion force while passing from England to France. In the invasion of the Philippines we always had to consider the large Japanese navy with its air force eager to attack us.

Our successful landing in the Philippines in the face of the Japanese ground troops and ground-based planes thoroughly disproves Major de Seversky's long-maintained contention that in the face of ground-based planes a successful invasion could not be made. The landing in Africa was against a weak defense both on the ground and in the air and so was not a real test. The landings in Sicily and Italy, while meeting more opposition from the air than was used in Africa, still did not constitute a real test because the Germans were retiring north and the Italians were not offering a stiff resistance. The invasion of France from England was not a real test because the invasion was supported not by seaborne planes but by a tremendous force of land-based planes coming from only a few miles away in Britain.

In the case of the Philippines invasion, the Japanese had plenty of land-based planes to oppose us. Some even came from Formosa. The covering of our landing, the support of the troops as they advanced into the interior of Leyte, and finally the attack of the Japanese fleet assisted by both their naval and land-based aviation had to be met by our carrier-based planes.

No China-based *Superfortresses* participated in this. They were limited to attacking Japanese shipping in the China Sea and the Formosa Channel. Other American land-based aviation, as far as is known, attacked targets far from Leyte.

This was the typical American campaign of the future if we are to protect ourselves from invasion and not be dependent upon allies overseas. It proved that success can only come when ground troops, warships and aviation are used together, each to its fullest capacity and as a united whole.

With all the changes which aviation has brought about in the past 20 years, there is probably no sphere in which it has altered previous conceptions more than in sea warfare. Because of the long distances which aircraft can fly ahead of a fleet, the speed with which they can accomplish their missions, and their flexibility by comparison with surface ships, they permit a bolder and more far-reaching strategy than has ever been possible in the past. Our present Pacific strategy

YEARS AGO

FROM the February, 1930, issue of this magazine:

A report on the "first nation-wide air tour ever conducted by a commercial fleet" (the General Tire and Rubber Co.) listed total operation cost at 15 cents a mile over a five-months tour for each of the seven three-place cabin monoplanes used.

The Packard Diesel engine—a nine-cylinder, aircooled radial capable of about 200 h.p. at 1,900 r.p.m.—powered the flight of a Stinson *Detroiter* from Detroit to Langley Field, Va., at a total fuel cost of only $4.68.

The U. S. Army Air Corps announced the substitution of a triangular mainsail for the circular one formerly used on standard parachutes.

It was reported that a Soviet aviation society called "Friends of the Air Fleet" had enrolled more than 2,000,000 members in 32,000 organization units. Their goal: "5,000 aviation centers and the world's largest air fleet."

"I have no hope," wrote John M. Vorys, Ohio's director of aeronautics, "of securing a state appropriation for the training of pilots at any state-supported university in Ohio."

Parks Air College advertised the addition of a tri-motored Ford to its fleet of training planes. Parks students, the ad said, get their night transport training in a Parks P-2 biplane.

Amelia Earhart had just set a new world's speed record for women—184.17 m.p.h., in a Lockheed *Vega*.

One of the latest planes was the 160-m.p.h. Laird *Speedwing*. It was offered to sportsmen at a price of $11,500.

The "largest passenger-carrying plane in the United States" was being built at the Emsco Aircraft Corp., Downey, Calif. The plane was to have four engines, a wingspread of more than 100 feet.

In the classified ads: "Giri parachute jumper wants contract with reliable company in south. Experienced. Owns chute."

would never have been possible before.

As a result of that strategy we are nearing the time when we can bring greater power to meet the Japanese forces. Luzon is only 1,200 miles from Japan itself, 700 miles from China. From the standpoint of aviation, with Luzon in our hands it will make no difference that we have lost to the Japanese our principal air bases in China. In fact, we will be better off with air bases in Luzon than in interior China because, since we now control the Pacific Ocean between the Philippines and the U.S. west coast, we can transport much more easily the aviation supplies needed to attack Japan's sea lines south through the China Sea.

Our aviation will be in a splendid position to attack Japan itself and Japanese activities on the continent of Asia. This is a marked contrast with the limited activities when our China-based aviation had to be supported out of supplies flown over The Hump. END

Before I Buy a Plane . . .

(Continued from page 31)

bility which we cannot otherwise expect. If and when we build airplanes to use small one-way fields and attempt to move those fields close in, we are going to be brought up short by the objections of neighborhood residents to the noise unless it is eliminated or greatly reduced. Even in outlying districts airport projects have already been blocked for this very reason.

We also neglected cockpit vision, detracting immeasurably from the pleasure of flying and introducing traffic control problems that are now taking on ominous proportions in the expectation of increased traffic density.

Finally, we paid little attention to making flying easier to learn. Instead of decreasing the amount of skill required to attain reasonable flying safety we multiplied the required skills and initiated an ever-growing mass of regulations which have discouraged many from even attempting to become pilots.

Now let us examine for a minute what could have been done—and what we can yet do. Hind-sight is better than foresight, so let us look backward first.

The Wright Brothers first demonstrated their airplane to the Army from the parade ground at Fort Bragg, an operation area too small for present planes.

The Bleriot which first crossed the English Channel had castered main wheels which permitted cross-wind landings. Our present airplanes require sufficient runways so that they will never have to land more than a few degrees cross-wind. The tricycle gear which is now serving well in both military and commercial airplanes was also dug up out of the past.

It is not certain that the Wright Brothers' first airplane was any quieter than our present ones, but with its two slow-speed propellers driven from one engine it could well have been.

In both the Wright and Bleriot planes vision was almost perfect and, believe it or not, the Wright airplane was equipped with a yaw and angle-of-attack meter. Such an instrument is not now provided, although an angle-of-attack meter would be extremely useful in shortening instruction time and in avoiding stall accidents.

In 1934 the Department of Commerce fostered the development of a so-called "safety airplane." It was my pleasure to let many people who had not previously flown take this plane off, fly it where they would, and land it while I simply sat beside them and told them what to do. Later in 1941 the Civil Aeronautics Administration conducted a research training program on a similar airplane and as a result was able to recommend almost a 50 per cent reduction in training time for a pilot certificate limited to operation of that airplane.

That same year, the Department of Commerce also fostered the development of a roadable autogiro. Again it was my pleasure at one time to fly this machine to Baltimore, land it at the Curtiss-Wright Airport, drive it through the city, and exhibit it at an automobile show.

These are all past accomplishments. What we may be able to do in the future no one knows. But here's a concrete example of what a great many people want.

The plane I want—and, what's more important, the plane my wife wants—is the closest possible approximation to the magic carpet. It must "float through the air with the greatest of ease," it must go slowly, it must deliver us to our front door.

Like most prospective purchasers we want an airplane for pleasure. We cannot enjoy feeling our plane shake and hearing it roar in its effort to keep us afloat. We want to enjoy the scenery we fly over. That means we want to be able to slow down occasionally and see the same things at the same time and not at times separated by periods of violent aerial maneuvering.

Next comes front-door delivery. We can't afford two cars and an airplane. Our one car must be available for those not flying. It cannot be left at the airport. Nor can we gear all the family's schedules to the use of the airplane by having someone take the flyers to the airport. Furthermore, we want to keep it home so our neighbors will know we have it and so we can show it off to our friends. Although it would be nice to land in our yard we just do not have room for landing even a helicopter. All this adds up to a plane that will take us to our door via the ground.

This airplane must use short one-way strips if it is to land close to our home. Since I will probably do most of the piloting, there must be no difference in procedure between cross-wind and into-the-wind landings—I never was very good at telling which way the wind is blowing.

But the one-way strip close to home is out unless we can take off without disturbing the neighbors. They just won't permit it. They will demand that we make no noise and that we clear their homes with sufficient altitude so that they will not be worried about our dropping in unexpectedly.

There is another feature which would interest us. When the nights get hot in Washington it would be a pleasure to fly to Skyline Drive after dinner, sleep in the airplane, and come back to Washington

GULPED LIGHTPLANE

ANYTHING can happen in Alaskan aviation—and usually does. CAA personnel in Anchorage, for instance, recently asked that an Aeronca be sent up to them from Juneau. The CAA's wide-doored DC-3 happened to be at Juneau at the time, so Pilot Jack Jefford said: "If you can get it in, I'll fly it up." Mechanics dismantled wings and landing gear, and the fuselage went in nose first. Then, after the wings and wheels were in, 10 passengers got in and the whole load flew to Anchorage.

for breakfast after a good night's rest.

If we are asking too much then I guess we just aren't good prospects. But we are like the 85 per cent of the helicopter prospects and the 77 per cent of the roadable airplane prospects in *Collier's* survey who say they will wait until they can get what they want.

But are such expectations unreasonable?

The aviation engine operates on the same principle as the automobile engine. The auto once rattled our bones and deafened our ears but that day has passed. The propeller is now noisy but slowing it down will largely eliminate this noise. Large diameters could be avoided by using multiple propellers. The development of a light power transmission for this purpose is not an insurmountable problem and the propeller weights and efficiencies could be better than with single propellers.

Slow speed and steep climb are two of our requirements. Unfortunately the airplane needs power to keep itself in the air as well as power to overcome friction. The former decreases with speed and is small at slow speeds. The latter increases. But how much? At 15 m.p.h. it is less than the power of the airplane's engine. That is slow enough for us and as we are carrying the engine with us anyway we don't see why we shouldn't use it for slow speeds.

I have never designed airplanes but I visualize an airplane such as that shown in the accompanying sketches as one that might meet our requirements.

The little propellers are placed above the wings where they cannot get themselves or us into trouble. Tests have shown that air blown from slots in the upper surface of the wings produced high lifts. These propellers could accomplish this end. Theory says the lift depends on the rate at which the air circulates around the wing. Rotating cylinders are reported to produce lifts 25 times that of the airplane wings by creating a high rate of circulation of air when rotated. These propellers would increase the rate of circulation.

This proposal is designed to place the entire wing in the propeller slipstream. A modification of the principle was the Crouch-Bolas biplane of 1934 which obtained considerable lift by covering the greater part of the wing with the slipstreams of two large low-speed propellers. In this plane, the airscrew axis was tilted slightly downward. Surprising lifts were obtained and the minimum speed was as low as 30 m.p.h. Even at such speeds, the slipstream across the wing is high, resulting in high lift at what would be stalling speeds in other aircraft. Yet the idea was suggested as far back as 1912 by Bleriot.

The wings could be made to fold back on pivots at the trailing edges and then rotated up to lie flat above the booms. They could be carried there or the wings and tail could be removed and left at the flight strip.

The front wheels are steerable and the rear wheel is castered with springs tending to hold it straight. Thus if we land cross-wind the rear wheel will permit the airplane to move along the runway while it maintains a heading partially into the wind until the spring again centers the wheel.

The backs of the seats could be arranged to fold down to form beds.

If this airplane can be made to meet our requirements we are good sales prospects. We are not prospects for improved versions of 1917 models.

the British Say...

Consolidated *Catalinas* are flying the world's longest non-stop air service (more than 3,500 miles, across the Indian Ocean). Average time each way is 27 hours. Each *Catalina* has special long-range tanks, can fly 36 hours nonstop and averages 130 m.p.h. on these flights. Gross weight of each *Catalina* is 35,000 pounds; the fuel load is 16,000 pounds (about 2,670 gallons). Each plane's payload is 1,000 to 1,200 pounds, which usually is divided between an average of three passengers and an average mail and freight load of 500 pounds . . . Additional specifications on the Northrop *Black Widow* (P-61A): wing area, 500 sq. ft.; aspect ratio, 8.7; wing loading, more than 50 lbs. per sq. ft. . . .

—FLIGHT

U. S. Air Transport Command aircraft are crossing the Atlantic at the rate of one every 22 minutes, the Pacific every 102 minutes and The Hump between India and China every 10 minutes . . . The Budd *Conestoga* (RB-1 in the U. S. Navy) has been designated C-93 by the AAF . . . The newest version of the North American *Mustang* is powered with the Rolls-Royce *Griffon* engine . . . A Douglas *Skytrain* (C-47) without engines has been tested by the AAF as a prospective transport glider . . . A recent German broadcast gave the bomb load of the B-29 as 22,000 pounds . . . A Boeing *Flying Fortress* bearing German air force markings recently was forced down near Valencia, Spain, and its crew of nine—all Luftwaffe members—was interned . . . Since 1940, 25,000 airplanes have flown the Atlantic . . . The U. S. Navy is testing the Bell *Airacomet* (P-59A) . . . Douglas Aircraft developed the XFD-1, a single-seat fighter for the U. S. Navy, but it did not go into production . . . The Vought division of United Aircraft has designed and built a twin-engined lightplane for the postwar market . . .

—THE AEROPLANE

We paid about $1,200 for our car. We could scrape up another $800 to have both car and plane. But our car is now a compromise—built for both city and country driving. A car better than ours for city driving only should not cost over $500. For the airplane described, $1,500 should be ample.

There is no insurmountable barrier to the building of airplanes like this one. And they can be sold in quantities. All that is required is that manufacturers stop drifting along in the confident expectation that they can sell more pre-war airplanes in the post-war period than they sold prior to the war. They may do it, but if they do there is every reason to believe that one-third of their customers will become dissatisfied within a year of their purchase. To me it would seem much better to discourage all such sales except to the few who may be expected to remain satisfied. Other industries find dissatisfied customers a liability, not an asset.

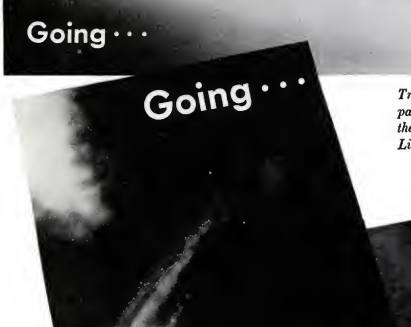
And even this flash market for pre-war airplanes constitutes only 27 per cent of the total potential post-war market according to the *Collier* survey. The survey shows a still larger market of 39 per cent who want roadable airplanes and who, for the most part, say they will wait until they are available. It is not smart merchandising to tell these people they are mistaken and that they should buy the airplane the industry prefers.

As a youngster in high school, I had a job clerking in my spare time at a neckwear counter. When I first looked at the array of ties I thought that the buyer should have been fired. Then I tried to sell everyone the ties I liked. I sold very few and even some of these came back. Then I learned that it was possible to create a satisfied customer by selling him a tie he liked—even though it was one that I wouldn't wear on a bet—and my sales increased remarkably. Just so will our personal airplane sales increase when we offer to the public the airplane it wants instead of insisting that it buy what appeals to us.

But improvements in the airplane are not in themselves sufficient. If we are to have any amount of personal flying, airport operators and attendants must forego the pre-war attitude so many had that they were conferring a great favor on the private pilot even in permitting him on their fields. Years of association with aviation, great piloting skill, and a profound knowledge of airplanes will not suffice as qualifications for airport personnel. Unless they also practice the art of merchandising, personal flying cannot become popular.

It is just as essential for the over-all success of the industry that airports give good service to a visiting pilot who may not spend a cent with them as it is to give good service to those who are regular customers.

With respect to regulations, the industry bears equal responsibility with the government for pre-war conditions. The automotive industry could not possibly have reached its present magnitude under regulations similar to those imposed on personal flying. Consider the physical requirements for a pilot certificate. Originally based on Army-Navy requirements, reductions to their present status have been opposed every inch of the way by the medicos. They want to keep out of the air every person who might possibly be an unsafe pilot. They argue that they have no responsibility to get people into the air. Stated in another way, it is perfectly proper to keep 49 safe pilots on the



Trails of smoke and a blanket of flames accompany this Jap flying boat on its final plunge to the sea. Chalk up one more "kill" for a Navy Liberator. Official U. S. Navy Photographs.

Our little slant-eyed "friends" are learning, the hard way, how decidedly unhealthy it is to tangle with one of the Navy's big Consolidated Liberators. For these Liberators are not only great ships . . . they are manned by keen-eyed, straight-shooting, "hell-for-leather" American boys who like nothing better than to get a Nip flying boat, such as the one pictured here, in their sights.

It is gratifying to us here at CECO to know that CECO carburetors and fuel pumps on these newest great Liberators are doing their part in helping our fighting men beat a path to Tokyo. And we pray that the day is not too far distant when once again CECO products will be earmarked for airships rolling off peacetime assembly lines.

CECO

CARBURETORS

FUEL PUMPS

PROTEK-PLUGS

CHANDLER-EVANS CORPORATION SOUTH MERIDEN CONNECTICUT, U. S. A.

ground if by so doing they can keep the one unsafe pilot out of the air.

One after another, physical characteristics which were claimed by the doctors to be essential to safe flying have been proved non-essential. Depth perception has been proved unnecessary and normal functioning of the balancing mechanism in the ear, which was considered so important, has been found actually to be a disadvantage. On top of all of this, it has been found that there is little consistency in the doctors' examinations—some finding one deficiency and others an entirely different deficiency in the same applicant.

This situation has resulted in examination stress being transferred by the doctors from physical fitness to mental fitness. It is now their contention that there are individuals who are accident-prone. But this is a job for the inspectors. Insistence that such people can be sorted by preliminary examinations promises even more inconsistency than we have had in measuring physical fitness for our pilot applicants.

I have heard the argument that this question of physical examinations is unimportant because there are only 15 or 17 per cent who have disqualifying deficiencies. This argument ignores completely the effect of requiring a physical examination from an especially designated specialist, with its implication that some special physical characteristics are required. That these requirements do create that impression was amply demonstrated in the *Collier* survey. In this survey the number of those who believed that they could not meet the physical requirements was extremely significant. The figures were 15 per cent in the age group from 18 to 24; 18 per cent in the age group from 24 to 34; 24 per cent from 35 to 44; 41 per cent from 45 to 54 and 72 per cent of those over 55 years.

The Civil Aeronautics Board recently indicated that it believes its duty is to protect the people from the unsafe pilot and not the pilot from his own actions. It is therefore interesting to look into the probability of a sudden change in physical condition without forewarning resulting in an injury to a third party. First, the collapse would have to occur while piloting. The average pilot cannot be expected to spend more than 1/50 of his time piloting, so only one out of 50 collapses could be expected to occur in the air. Second, the resulting accident would have to injure a third party. The latest information I have indicates that only one out of 300 serious accidents has resulted in injury to third parties. The probability of third party injury by sudden physical collapse is, therefore, in the order of one injury per 15,000 collapses. There are about 30,000,000 automobiles in this country and about 30,000 automobile fatalities per year. Of these, about 40 per cent are pedestrians. The probability that your car will kill a pedestrian within a year is therefore in the order of approximately one to 2,000.

Cold figures rather than vivid imaginations should govern our regulations and cold figures do not substantiate the necessity of any physical examination, much less an examination by a designated physician. If these figures are considered along with the fact that only a small part of our flying population have disabling diseases and that, for the most part, presence of such diseases will not be discovered by the examining physician unless the applicant voluntarily discloses them, the necessity of any physical examination other than questioning by the inspector is highly debatable.

In the pre-war period, a record of every personal flight had to be recorded in the pilot's log book, the airplane log book, and the engine log book. Although some consideration is now being given to a change, the regulation still stands. The information which had to be recorded in the pilot's log book was "date of flight, make or model of aircraft flown, its type, weight and engine classification, the aircraft identification mark, a statement of solo, dual instruction, instrument and night flying time, the duration of flight, the points between which such flight was made, and in addition, when any flight results in serious damage to the aircraft, a notation to this effect."

It was not necessary to note the purpose of your trip or to name the person called on.

These regulations concern only log books. There are many more that are not concerned with the rules of the road which are admittedly essential.

There are also requirements for the attainment of a pilot's certificate, including examinations in meteorology and navigation that are far from simple. The chances of injuries to a third party or even to the pilot which would result from eliminations of these examinations would be even less than those which might result from curtailment of physical exams. Few pilots use the navigational methods included in the examinations, and most of them depend upon the experts in the weather recording service to advise them relative to the weather.

With these brief comments, I leave to your imagination the extent to which post-war personal flying could be stimulated by a change in regulatory policy.

To summarize, here's what personal flying could be after the war, if all concerned played their part:

One million families would own an automobile and an airplane. The automobile would be built for city driving only, easy to park, and much cheaper to operate. Its first cost would be $500. The airplane would be either two or three place or four or five place, the former costing $1,500 and the latter $2,500.

Airplane wings would fold for operation on the highway and wings and tail surfaces would be removable when desired. Seats would be arranged so that by folding them back you could sleep in the plane. The plane would operate from strips 1,000 feet long and 100 feet wide irrespective of the direction of these strips to the wind.

Flight strips would be within easy reach of your house, where the airplane would be kept, and additional flight strips would be located at remote country clubs, beaches, national parks, and along the highways. There would also be aerial tourist camps.

The plane's minimum controlled flying speed would not be over 25 m.p.h., the cruising speed not less than 90 m.p.h., and it would be relatively quiet.

To get a pilot certificate one would only have to demonstrate one's ability to fly safely in clear weather, plus a knowledge of the rules of the road. There would be no regulations other than the rules of the road except those required to keep your airplane airworthy. END

"Why not? It works with airplanes."

"It sounds to me like a job for Aeronautical Products, Inc."

WHAT KIND of precision parts does *your* post-war job require? Automatic screw machine . . . grinding . . . thread grinding . . . thread milling . . . superfinishing . . . hyprolapping . . . heat treating . . . nitriding . . . plating . . . magnafluxing . . . tolerances as low as .0001? The point is this: If your assemblies require the machining of parts to hair-breadth limits, we're equipped to do the job faster . . . better! In one organization with two great plants, ALL the facilities ANY job requires.

AND THAT'S NOT ALL! With a solid foundation built on the top-speed production of precision units for aircraft engines long before Pearl Harbor, plus 100% war output, it stands to reason we'll retain our leadership after the war is won! If *you* have a post-war problem, consult "Precision Pacesetters", with a *record of accomplishment!* Want ideas? Engineering help? Costs? Write our Executive Sales Offices for complete list of equipment and facilities.

● *THE SUCCESS of The Aeronautical Products, Inc. Helicopter, designed and built by our own craftsmen, promises new accomplishments in the post-war age of flight!*

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Who Controls the Air?

(Continued from page 29)

Mr. Justice Hughes stated that the general principles governing the exercise of state authority when interstate commerce is affected are well established and that the power of Congress to regulate commerce among the several states is supreme and complete and, he added, may be exercised to its utmost extent and acknowledges no limitations other than those prescribed in the Constitution of the United States.

The Justice quoted Chief Justice Marshall, that

> "*The completely internal commerce of a State then, may be considered as reserved for the State itself,' but, 'this reservation to the State manifestly is only of that authority which is consistent with and not opposed to the grant to Congress.'*"

This is the *first* sphere of the three pronounced by the court. It means that the Constitution vested in the Federal Government all control of interstate commerce to the exclusion of the states. This grant in the Constitution, without action by the Congress, established the essential immunity for interstate commerce from the direct control of the states.

Examples of the powers granted the United States by the Constitution are (1) prohibition against the states in taxing interstate commerce, (2) a lack of power in the states to prohibit interstate trade in legitimate articles of commerce, (3) exclusion from the limits of the state, corporations or others engaged in interstate commerce, or to create limitations of the right of corporations to carry it on, (4) to prescribe rates to be charged for transportation from one state to another.

But within these limitations there necessarily remains to the states, until Congress acts, a *second* sphere within which the states may act, although interstate commerce may be affected. These powers relate to local matters. Examples in this sphere are local action with respect to pilotage in view of the local necessities of navigation, protection of the coasts of the state in relation to improvement of its harbors, bays and streams, and the construction of dams and bridges across the navigable rivers within its limits. But, of course, they must not interfere with interstate commerce and generally the court has not found that the exercise of such powers constitutes a direct burden upon intercourse or exchange of traffic, even though the Congress has not acted with respect to the subject.

And for the *third* sphere, the Minnesota Rate cases again quoted Chief Justice Marshall, that within the state's power is "that immense mass of legislation, which embraces everything within the territory of a state, not surrendered to a general government; all which can be most advantageously exercised by the states themselves. Inspection laws, quarantine laws, health laws of every description, as well as laws for regulating the internal commerce of a state and those which respect turnpike roads, ferries, etc., are component parts of this mass.

"No direct general power over these objects is granted to Congress and, consequently, they remain subject to state legislation. If the legislative power of the union can reach them, it must be for national purposes; it must be where the power is expressly given for a special purpose, or is clearly incidental to some power which is expressly given."

It is clear from the foregoing that the interstate and intrastate jurisdiction are fairly well defined and that, generally, with these rules in mind, it was possible for one experienced in the law to predict fairly accurately into which category a specific problem may fall.

But to return now to the principal subject, that is, the authority of the United States Government over flying in the United States. Let us examine the provisions in the Civil Aeronautics Act of 1938 as amended to determine whether, by passages of this act, Congress exercised jurisdiction over all flying in the United States.

It seems clear from the definition in the Minnesota Rate Case that if any type or regulation of flying by a state constitutes an undue burden upon interstate flying, that regulation is not valid. This comes under *sphere number one*, to the effect that the states cannot under any guise impose direct burdens upon or interfere with interstate commerce.

The airplane passes state lines so rapidly that it is just naturally in interstate commerce. One cannot imagine it being

(Continued on page 107)

EASTERN Air Lines

...counts on Curtiss Commandos

FOR MORE FREQUENT AND FASTER SERVICE

Our new medium range Commando Silverliners will be particularly well adapted to Eastern's frequent flight schedules linking practically all principal cities in Eastern, Middle Western and Southern States.

EDDIE RICKENBACKER
President and General Manager
Eastern Air Lines

As part of a $25,000,000 domestic and international expansion program—that will multiply its mileage by five times in a three year period and by approximately ten times in five years—Eastern Air Lines is adding the Curtiss Commando, world's largest and fastest twin-engined transport, to its Great Silver Fleet.

This selection was the result of Eastern's two years' experience, operating a fleet of Commandos for Air Transport Command on regular schedule. Under ATC direction, Eastern Air Lines pilots flew Commandos more than ten million miles, largely over water to South America and Africa.

Originally developed by Curtiss-Wright in cooperation with airline engineers as a commercial transport, the Commando with its powerful 18 cylinder Wright Cyclone Engines, meets a definite demand for larger payload, greater reliability and reduced operating costs on flights up to 700 miles in length—a range that covers over 90% of all domestic air travel. *Look to the Sky, America!* Curtiss-Wright Corporation, Airplane Division, Buffalo, New York.

COUNT ON *Curtiss-Wright* FOR ACHIEVEMENT IN THE AIR

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AIRCRAFT ENGINEERING CORPORATION, Bethpage, L. I., N. Y.

(Continued from page 104)

restricted to intrastate areas. Therefore, whether the Civil Aeronautics Act of 1938, as amended, contains any direct reference to the assumption of the jurisdiction for interstate purposes by the Federal Government is probably of no moment. It is not improbable that upon the establishment of cross-country flying, whether by air carriers or private pilots, that the interstate jurisdiction under the commerce clause was immediately brought into play without any action by Congress.

Of course, in order to define and limit such jurisdiction of the national Government, it was essential for the Congress to speak on the subject. But in the absence of such action a *state could not act to unduly burden interstate commerce.*

In the Civil Aeronautics Act of 1938, as amended, and Subsection 3 of Section 1 thereof, air commerce is defined as:

> ". . . *interstate, overseas, or foreign air commerce or the transportation of mail by aircraft or any operation or navigation of aircraft within the limits of any civil airway or any operation or navigation of aircraft together which directly affects, or which may endanger safety in, interstate, overseas, or foreign air commerce.*"

Then Section 3 of the same Act contains a declaration by the Congress. It states:

> "*There is hereby recognized and declared to exist in behalf of any citizen of the United States, a public right of freedom of transit in air commerce through navigable air space of the United States.*"

So the definition of air commerce, read in connection with the definition of interstate air commerce in Section 1 of the Act, covers the operation or navigation of aircraft in the conduct or furtherance of a business or vocation, and the declaration contained in Section 3 gives every citizen of the United States a right to navigate in air commerce through the navigable airspace of the United States.

Perhaps these provisions of the Civil Aeronautics Act of 1938, as amended, constitute a realization on behalf of the United States of America of the existence of flying in the United States and thereby indicate without question an intent of the Congress that the United States of America shall exercise all of its powers over aviation under the commerce clause of the Constitution.

But doubts remain and arguments are many. Just recently, identical bills H. R. 4845 and H. R. 4848 were introduced in the House. Each would amend Section 1 (21) (a) of the Civil Aeronautics Act of 1938, as amended. The purpose of the amendment, it has been said, is to prevent attempted state regulation of interstate air commerce.

But notwithstanding these authorities, the Civil Aeronautics Board, on December 1, 1941, amended sections 60.30 and 60.31 of the Civil Air Regulations, which declare in effect that safety demands that all flying in the airspace overlying the United States is in interstate commerce. This regulation promulgated by the Board requires every pilot to be certified by the Federal Government (CAA) and every plane to have an airworthiness certificate issued likewise, with certain exceptions not here controlling.

Early in 1940 and prior to the time the Board had promulgated this regulation designed to define all flying as interstate flying, the activities of the Rosenhan brothers in the State of Utah were brought to the attention of the Administrator of Civil Aeronautics. They had built their own plane but did not have a type certificate for it.

Likewise, these brothers did not possess an airworthiness certificate for the plane or CAA pilot certificates for themselves, although they held certificates from the state of Utah. It thus appears that they were not conforming to the law of the United States, the Civil Aeronautics Board regulations and the regulations of the Administrator of Civil Aeronautics.

The United States Attorney at Salt Lake City, at the request of the Administrator of Civil Aeronautics, filed a complaint in the Federal Court of the United States for the District Court of Utah charging them with violations of the law and the regulations of these two authorities. This case was affirmed by the United States Circuit Court of Appeals for the Tenth Circuit and the Supreme Court of the United States refused to hear it.

The Rosenhan Brothers contended the Civil Aeronautics Act was unconstitutional as far as it applied to flights within the State of Utah. As mentioned earlier, the Rosenhan Brothers held certificates issued by Utah under a statute of that

state. This statute contained a declaration to the effect that the state possessed exclusive jurisdiction in the airspace over this state.

It should be added that the Rosenhan brothers utilized the Federal Civil Airways in Utah. This is one of the distinguishing factual features of that case and the Drumm case. The court in the Rosenhan case entered judgment on the pleadings so no evidence was introduced as in the Drumm case. The United States Circuit Court made reference to the commerce clause as the fundamental power for enactment of the Civil Aeronautics Act. The court stated:

"We think the pleadings as thus cast present clearly and concisely the bare legal question whether the Congress may in the exercise of its commerce powers, by its definition of interstate air commerce, include within its scope 'any operation or navigation of aircraft within the limits of any civil airway,' and thereby forbid the intrastate operation of a civil aircraft within a Federally designated airway, unless there is currently in effect an airworthiness certificate issued by the duly constituted Federal authority. . . ."

The Rosenhan case definitely limited flying in uncertificated aircraft by uncertificated pilots over or across the Federal Civil Airways even though conducted wholly within state boundaries. There remained relatively large areas in some states wherein flying could be conducted without making contact with a Federal Civil Airway.

The flights of Andrew D. Drumm, Jr., were in this category.

Judge Norcross, in the Drumm case, had for consideration the commerce clause, the statutes, the Civil Air Regulations and the Rosenhan cases, among others. The Judge stated in his opinion of May 1, 1944:

"No cases were cited and none appear to have been rendered dealing directly with the law controlling a state of facts similar to those herein involved. The nearest approach to such a citation is the case of Rosenhan v. United States from which opinion is quoted the following excerpts:

" 'The Civil Aeronautics Act, supra, was enacted as advanced legislation in recognition of rapidly growing air commerce and was comprehensively designed to promote civil aeronautics, and to that end develop and secure maximum aeronautical safety . . . The Act created a civil aeronautics authority to be composed of expert personnel, with powers to effectuate the full purpose of the Act . . . Congress has not seen fit to limit the question of safety in these circumstances to a manifestation of actual danger, rather it has sought to eliminate all potential elements of danger.' "

A fine of $2,500 was imposed upon Mr. Drumm and a lien for this amount was placed upon his aircraft. He was permanently enjoined from flying until he obtained a pilot's certificate.

Thus the Minnesota Rate Cases and prior decisions of our Supreme Court laid down the rules with respect to the powers of the Federal Government and the states in interstate commerce. Even without the Rosenhan case or the regulations of the Civil Aeronautics Board, the same decisions could have been reached, since the flights of Mr. Drumm were considered to endanger safety in interstate commerce.

Some support is found for this position in Northwest Airlines Inc. v. State of Minnesota, decided by the Supreme Court May 15, 1944, which, by the way, was a four to five decision. One of the concurring justices, while "warming up," made several pertinent observations which indicate the relationship of air carrier operations to the commerce clause.

"We are at a state in development of air commerce roughly comparable to that of steamship navigation in 1824 . . .

"Aviation has added a new dimension to travel and to our ideas. The ancient idea that landlordism and sovereignty extend from the center of the world to the periphery of the universe has been modified. Today the landowner no more possesses a vertical control of all air above him than a shore owner possesses horizontal control of all the sea before him. The air is too precious as an open highway to permit it to be 'owned' to the exclusion or embarrassment of air navigation by surface landlords who could put it to little real use.

"Students of our legal evolution know how this Court interpreted the commerce clause of the Constitution to lift navigable waters of the United States out of local controls and into the domain of Federal control . . . Air as an element in which to navigate is even more inevitably federalized by the commerce clause than is navigable water. . . ."

Now that the power of the United States of America to prescribe safety regulations to govern flying of civil aircraft in the United States has been established, subject, of course, to reversal by the Circuit Court of Appeals or the United States Supreme Court, it is hoped that this regulation after the war will be temperate and wise—that it will be the very minimum of restraint compatible with safety in its broadest sense.

To this end and in contemplation of the increase of civilian flying, the Civil Aeronautics Board has proposed to revise and simplify those appropriate parts of the Civil Air Regulations. Should the hopes and aspirations of the Board and other interested agencies and persons be realized, these revisions will be in time to meet the post-war demands. Every person who has the urge to fly should have that opportunity, limited perhaps only in consideration of other aircraft and persons and property on the ground.

EDITOR'S NOTE—At the recent National Aviation Clinic in Oklahoma City, the National Association of State Aeronautical Officials (NASAO) considerably modified its earlier ideas on the scope of state aviation departments as reported in the January issue of FLYING ("Must We Have 48 Air Dictators?"). NASAO offered a model uniform act for state aeronautic departments.

Hitherto the CAA had opposed state regulation of flying but changed its mind with the switch in NASAO's ideas of "developing and promoting" aviation. The words "co-operation" and "co-ordination" appear throughout the act when referring to Federal-state activities.

Briefly, the uniform act, which has CAA approval, emphasizes the need for state assistance in enforcing safety regulations and sets up state aeronautical commissions with regulatory powers. The states could establish safety rules and regulations provided they presented no conflict with existing Federal regulations.

The law further provides that states can require state registration of Federal certificates of airmen and aircraft al-

POST-WAR AMPHIBIAN

ANOTHER contender for the post-war light amphibian market is this twin-engined design produced by Allied Aviation Corporation, Baltimore, Md. It is reported that Allied is negotiating with another aircraft manufacturer for the joint production of this design.

Known as the Trimmer amphibian, it closely follows the lines of the Grumman Goose and Widgeon. The Trimmer is believed to be the first plastics-bonded plywood amphibian yet designed. It is powered with two 85-h.p. Continental engines and can carry three people for a range of 350 miles. Present estimated sale price is about $4,000. It is expected to be ready for sale during the spring of 1945. Some specifications:

Wing span	35 ft. 8 in.
Length	24 ft. 9 in.
Height	7 ft. 4 in.
Cruising speed	115 m.p.h.
Landing speed	45 m.p.h.
Service ceiling	12,000 feet.

though charges for such registration must not be more than $1 for each certificate. The "police" powers of the state aeronautical department would include revoking or refusal of certificates on a basis of airmen incompetency, infraction of regulations, or unairworthiness of the aircraft.

The act would also grant these rights to the states: Licensing of flight schools, instructors and airports; establishment of state airways co-ordinated in design and operation with Federal airways; accident investigation.

On the positive side, states would make available engineering services to minor political subdivisions without charge; would be able to assist municipalities financially and act as agents of municipalities in connection with Federal air programs, and would be able to establish and maintain state airports. END

Let Your Airport Go to Grass

(Continued from page 43)

Little consideration was given to the development of turf cover in the early stages of the airport construction program. The effect of dust on aircraft using the paved runways first focused attention on the need for additional types of cover. But though the problem was recognized, it was simply accepted as one of the inconveniences of flying. Dust stirred up by propeller blasts or by heavy traffic can cause as much damage to engines and equipment as the saboteur equipped with emery powder. Then, too, unprotected dirt surfaces are easily rutted and are subject to both wind and water erosion. If erosion occurs next to a paved runway, the edge may soon be undercut and crumble. The cheapest and most effective control of both dust and erosion is turf surfacing.

Weeds—and many grasses—do not give year-round protection. Soon after they die in the fall, their brown, brittle stubble begins to wear off. Before long, you are right back where you started—with dust, erosion and a rutted surface.

Despite the fact that aviation and its related sciences had been developing for about four decades, it took the war to provide impetus for a scientific study of airport turf. At the time, five months after Pearl Harbor, when the Army first engaged a turf specialist, the number of formulae one could get for growing turf on a specific field usually depended on the number of experts who were consulted. Records of the original specifications for the various turf fields were seldom available; they were rarely kept up-to-date with notations on use of the field or on maintenance data. Since then, many golf-green, park, soil-conservation and pasture specialists have been working exclusively on the problem, in both the War and Navy Departments. The Civil Aeronautics Administration has assigned an engineer to a nation-wide study of airport seeding and planting results in the effort to obtain comprehensive information on how to make turf grow and endure. Good turf production is no longer a problem for the agronomist alone. The soils expert, drainage specialist and engineer have added their experience and knowledge to provide the desired surface.

While it is still impossible to detail a foolproof program for producing perfect turf under all the conditions, real progress has been made in almost every aspect of the problem. If the knowledge gained in the past few years is applied in the presently contemplated airport turf program, entirely satisfactory fields will be obtained at a fraction of the cost of paved runways.

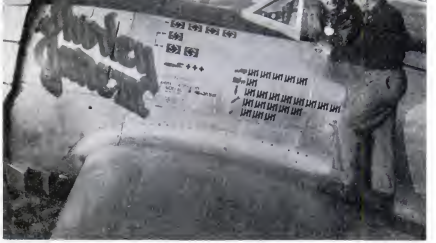
CAA describes turf as "a mass of matted roots of grasses and certain other plants, including the layer of soil in which they are growing and the plant growth showing above." The specifications require plantings of permanent grasses which will develop a dense, low-growing and wear-resisting turf. The more intensive the expected use, the denser the growth has to be and the more wear-resistant its quality.

As this is written, over 150 landing fields in 30 states have been visited for purposes of analyzing their turf development. Many of these fields have been visited more than once to study changing conditions. By co-ordinating studies of the results obtained, the maintenance program undertaken and the specifications drawn up at the time the turf was started at the various sites, it often has been possible to determine the cause of a specific failure and the elements in a particular success. Analysis of the failures and half-failures—and there have been plenty of them in the past—has provided clues to future successes.

Wartime pressure, with its immediate demand for usable fields, meant that good turf had to be developed on the first try. Grass experts of the old school threw up their hands. Everyone, they assured the engineers, knew that it took at least two years to develop adequate turf, longer for a really dense growth. Yet turf specialists did provide a usable turf for a twin-engined training program within six weeks from the time the grass was planted. Even this record—established in the bluegrass country—can be shaved by a few weeks in the southern Bermuda-grass region.

Selection of permanent grass depends primarily, like crops for your victory garden, on the climatic zone in which it is to be grown. You may know that a turf field of Bermuda grass in Florida provides first-rate landing facilities, but you cannot use Bermuda in Maine. Nor will a growth of bluegrass, which does so well in Maine, be possible in Florida. One guide is an examination of the types of grass that thrive at or near the site selected for the airport. There are over 2,000 different grasses—only about 30 of them are used in airport turf, however.

One innovation which speeds up growth of thick turf is an increase in the seeding rate. Where about 25 pounds of seed per acre might be specified for planting a bluegrass pasture, airport engineers sow



FIERY THUNDERBOLT

CAPT. EDWARD "Bill" Fisher of Portland, Ore. (in cockpit), flight leader of a group of 9th Air Force fighter pilots, has been a busy man. A graphic record of his exploits can be seen on the side of the fuselage. Interpreted, it means that Fisher had shot down four Fw-190's, one Me-109, two Me-110's, three robombs, shot up 25 truck convoys, five locomotives, been on 40 dive-bombing missions, 25 level-bombing missions, 15 sweeps.

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90 to 100 pounds of seed per acre. In adverse planting conditions the rate has been increased up to 200 pounds with good results. In addition, they use a smaller proportion of the temporary grasses—often included in seeding mixtures to provide a fast-growing shade for young seedlings of the permanent grasses. However, if the field is ready for seeding at a time when the permanent grass cannot be expected to do well, a temporary grass will provide surface for medium and light traffic within four weeks of planting. When the proper season arrives, the permanent grass may be planted by drill seeding without destroying the existing cover.

The traditional methods of fertilizing pasture land are by use of manure or by sowing with legumes—alsike clover, white clover or lespedeza—which are later plowed under to provide natural nutrients for the soil or allowed to grow with the pasture grasses. But airports cannot be treated like pastures; it has been necessary to use generous amounts of commercial fertilizer. It both increases the yield and speeds up growth. The elements in which soil is usually deficient are nitrogen, phosphorus and potash. The more successful turf fields are those which have been treated with a commercial fertilizer high in nitrogen, such as 10-6-4 (10 per cent nitrogen, six per cent phosphoric acid and four per cent potash). Some of them have been given a straight nitrogen application, such as ammonium sulphate or nitrate of soda. A high grade commercial fertilizer costs from $30 to $45 a ton.

Where the farmer might use 100 to 200 pounds per acre of nitrate of soda or 300 to 500 pounds of superphosphate per acre, turf specialists now prescribe 1,000 to 2,000 pounds per acre of a balanced fertilizer—usually high in nitrogen—for airport use. They found that 500 to 800 pound applications at intervals during the first years, as well as booster shots of straight nitrogen, increases the growth and density far out of proportion to the investment. If the site turns out to have a poor sub-soil or a sand or gravel mixture for the proposed seed bed, the chances are that some organic fertilizer will also be needed. Castor pomace, cottonseed meal and activated sludge have proved far more satisfactory for this purpose than manure, as the latter invariably contains weed seeds.

Airport turf specialists learned not only to co-ordinate their planting with the season (depending on the region, permanent seeding is done anywhere from February through September). They also watch the weather forecasts, taking advantage of local variations in rainfall—adequate moisture is a must in establishing turf. Watering in sufficient amounts where economically feasible will speed up growth by several weeks. It takes 27,000 gallons of water per acre to equal a one-inch rainfall. Occasional penetration down to three or four inches does far more good than more frequent shallow watering. Once the turf is established, water needs for rapid, thick growth are greatly reduced.

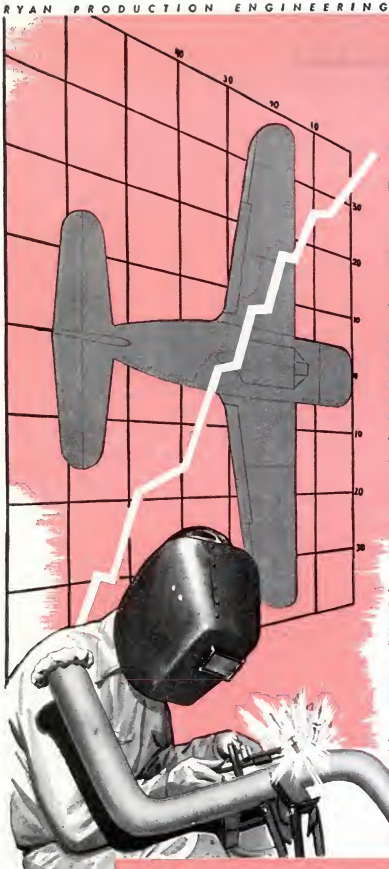
There are three new mechanical developments which will greatly benefit airport construction and maintenance. The first is a tractor-like gadget called a stone-picker. Since less than a dozen experimental machines were produced before the war and it is expected no more will be made until peacetime production can be resumed, there has been no opportunity yet to use the device in actual airport construction. Recent demonstrations, however, show real possibilities for its use on airport seeding projects. The tedious hand-raking and hand-picking of the site should be entirely eliminated by this machine. Not only does it pick up all stones —from those the size of an egg to those eight inches in diameter—over an area three feet wide at a time but in the same operation it pulverizes the soil down to a depth of three inches, thus preparing a perfect seedbed without other tillage operations. Good turfing specifications always call for removing all stones three inches or larger from both intensive and occasional traffic areas.

Another recent development is a sprigging machine, several types of which have been developed by the War Department and used on planting projects. It is particularly useful in the warm, humid region where Bermuda grass can be grown. The sprigs are coarsely shredded segments of sod. Bermuda grass can be planted by seed, sod or sprigs. Sprigging provides a quick planting means for establishing Bermuda turf. Before the war sprigs were dropped by hand at 14 to 18 inch intervals along a plowed furrow or were broadcast planted by means of a manure spreader. With normal fertilization, a usable cover was grown in three to six months. The cost—including obtaining the sprigs, preparing the field and planting—ran about $150 per acre. With one of the better developed sprigging machines which combines plowing, planting and watering, the job has been done for as low as $35 per acre. When sprigs are planted at seven- to nine-inch intervals and intensively fertilized, a field may be in use within three weeks from the time of planting.

The third mechanical aid is the high speed mowing machine. Mowing is so important to the establishment of good turf that turfing specifications must include mowing during the developmental period. Three to five inches is the grass height recommended on airports to prevent the development of seed heads on weeds and to eliminate competition with native and nurse grasses. This height also provides a sufficiently wear-resistant surface. It may take anywhere from three to 24 mowings a year to maintain that height, the number varying with the grass, the season and the climatic region. With the old sickle-bar mower it took several days at a dollar an acre to cut the 160 to 200 acres of grass on an average turf field. With the new reel type gang mower—a set of nine handleless lawn mowers so placed that the four in the second row take care of the gaps between the five in the front row—costs are cut to a few cents an acre. At 15 m.p.h. it can mow 275 acres in an eight-hour day.

One of the unexpected results of airfield turf studies is the realization that good grass can be grown in sand or gravel. One of the best Bermuda and carpet grass turfs recently observed on a trip through the south was grown in sand mixed with crushed limestone to give it sufficient stability and firmness to withstand heavy use. Other successful plantings have been made in mixtures of shell or marl with

RYAN PRODUCTION ENGINEERING DEVELOPMENT NO. G3033



WELDING INNOVATION BRINGS

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Ryan technicians, in their endless quest for greater efficiency and lower costs in airplane manufacture, are continually seeking out, improving and putting to new uses equipment and methods not previously used in aircraft work.

Take welding, for example. Ryan attained a 40% increase in efficiency in welding the thin gauge stainless steels used in aircraft by adapting atomic hydrogen arc welding, for the first time, to the fabrication of many important airplane parts and assemblies. New, lightweight electrode holders, specially alloyed steels and the use of a "controlled atmosphere"—all Ryan developments—did the trick.

This resourcefulness is typical of Ryan ingenuity in seeking out and applying newer methods and improving existing ways of doing things. In wartime, this means superior quality and greater production at lower cost to the taxpayer — in *big* as well as *little* ways. In peacetime, it will mean lower initial and operating costs for the improved products coming from Ryan production lines.

THE PROBLEM: When stainless steels were introduced in the manufacture of specialized parts for airplanes the headaches of welding were increased many fold. Thin gauge stainless steels required far more care than materials previously used and, at the same time, output needed to be stepped up to a high level. Ordinary welding methods were too slow and quite often were accompanied by scaling, burning, flux pockets and porosity.

THE SOLUTION: Ryan laboratory experts explored the entire welding field and found the solution by adapting the atomic hydrogen welding process. Using hydrogen (which excludes oxygen), they found, does away with porosity. Atomic hydrogen brings intense heat to the immediate surface without undue change in the metal structure—and there is little loss of the vital stabilizing elements of Columbium and Titanium. In addition the use of Ryan's "controlled atmosphere" method eliminates the need for flux.

THE ADVANTAGE: Atomic hydrogen lends itself to high-speed welding. Women can use it, after a few short weeks of training, with suteness and safety. It eliminates the prevalent defects of scaling, burning, flux pockets and porosity and increases the welding output of thin stainless steel parts 40%.

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the top three inches of sand. Sand in some regions has been stabilized by the addition of a two or three-inch cover layer of clay. Grass has been successfully grown under such conditions. Heavy soils, like the top soils of the midwest which are very unstable in wet weather, have been given firmness by the addition of a mixture of crushed stone. None of these three—gravel, sand or clay—are considered agricultural soils by the farmer and yet they have all produced excellent airport turf with the help of fertilizers. The fertilizing program needed to grow good grass must be carried out whether the medium with which you work is topsoil, subsoil, sand or gravel.

Actually, good topsoil helps; but it is not essential and its use need not be generally contemplated. The city whose airport budget is small can get good turf without topsoil by spending proportionately more on fertilizer and maintenance. Occasionally a well-planned turf program has been ruined because the topsoil had been taken from an area where the predominant growth was weeds. The weed seeds grew so well in the newly-enriched soil that the slower-growing grass didn't have a chance. Where good topsoil is available on the site it must be spread at least two inches thick to have any effect. Three inches is even better. In the northeastern part of the country where topsoil has been available and used, it costs approximately $135 per acre per inch of thickness.

Maintenance of the turf in good condition is mostly a matter of using common sense. Drainage ditches should be kept clear, shallow pockets filled in, bare spots reseeded, fertilizer used periodically and, most important of all, the grass must be mowed often to keep it at proper height.

A well developed, carefully tended turf field can take a lot of punishment. Parkersburg, W. Va., has an all-way turf field which is a good example. Although two strips are laid out across the field diagonally as indicated by corner markers, landings were made at any place on the field. Even *Skytrains* at times used this field without harming the turf. Although maintenance has been limited, the turf is in good condition. In the same northwestern part of West Virginia three other satisfactory turf fields were visited—at Weston, Moorefield and Petersburg. West Virginia's typically rough terrain makes airfields as important for transportation as they are difficult to construct. In some cases it has been necessary to do grading to the extent of filling in a 100-foot ditch or cutting off the top of a hill.

Another good allway turf field is at Cortland, N. Y. This field has excellent natural drainage. It has not received regular applications of fertilizer, but is mowed regularly. Most of the small post-war fields using turf will not get nearly the constant use in all types of weather which this field received. During two years of an intensive pilot training program there, not a single day of operation was missed because of the condition of the field. Wheel landings were made in up to five inches of snow and for real winter weather the planes were equipped with skiis. On the day when they switched back again they were able to use skiis in the morning and wheels in the afternoon. END

Airport Discipline Means Safety

(Continued from page 41)

ators and maintenance supervisors have worked to reduce accidents and cut down maintenance costs for many years. Preventive maintenance has done wonders toward reducing major accidents and cutting down on fatalities. Much has been learned about better inspections and methods of overhaul. New inspection forms completely eliminate guesswork. Facilities have been improved, better tools have been made available and all-weather shops have become widespread. Mechanics are better and they work under more favorable conditions.

But in spite of all this planning and effort we are still having accidents. I am thinking of the kind charged most often to carelessness, and for which there is no excuse. Because of their number, such accidents run maintenance well into the red at all times. Yes, in addition to preventive maintenance and controlled flight training we must have good *discipline*.

Discipline—or rather lack of discipline—at a base can be described in terms of accidents or costly mistakes, but it is very hard to define in terms of words.

"How can I get discipline at my base? How can I tell whether I have good discipline or need it? I am only having the average mistakes and I am taking every precaution I can to see that I do not come under the head of the careless operator." These are the questions asked and they are bothering many of us.

The first concrete evidence of lack of discipline will be accidents and increased maintenance costs. Jobs will take longer to complete and a job estimate will start falling short for no explainable reason. Small or serious accidents will occur and an investigation will give no logical explanation. "It just happened."

Let's discuss another accident to show how the little unimportant things can be contributing factors. Three pilots on a formation training flight flew to an airport several miles from their practice area and landed for a cup of coffee. After the cup of coffee all pilots with their students went out to the planes to take off. The first plane returned, zoomed the field and performed what he hoped was a spectacular chandelle at the end.

To the second plane this was sissy stuff. He dove the field and from about 100 feet attempted a slow roll. Just what happened is still a matter of debate but a badly needed instructor and a future Navy ace aren't with us any more. A plane that should have trained many students is a 100 per cent washout.

This accident was chargeable to poor discipline—discipline defined as that quality that makes a pilot, mechanic, or other employee do the right thing even though there is a strong temptation to

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take a chance if it won't be found out.

Discipline isn't the punishment of the violator after the accident but education and training before the accident. If the cause of this accident could be followed from its earliest contributing factor we would possibly trace the blame down the line in this manner: The manager of the operation at the time it was decided to include formation flying in the course probably called in the chief pilot, announced that there would be 10 hours of formation flying and that six pilots were to be selected to teach the subject in flight. The chief pilot, after careful consideration, selected six pilots on a basis of consistent good work and precision flying. These pilots were called in after they had been approved by the manager and were given an outline of the maneuvers they were to teach and the hours they were to work. Considerable time was probably spent in the air by the instructors practicing formation, developing precision and generally increasing their proficiency.

Now let us consider the day of the accident and the events leading up to the accident. First, there was no reason to leave the practice area. It was a violation of existing Civil Air Regulations, it cheated the student out of valuable instruction that he would someday need very badly, and it was a violation of the contract under which the instruction was being given.

This probably wasn't the first time the pilots involved had left the practice area for coffee—and as the number of violations increased it was only natural that each time something new be added, until finally it ended in tragedy. The responsibility can be traced back to the first day in the manager's office when he neglected to delegate the responsibility for each flight to the lead pilot. In the air, each pilot felt that he was responsible for his actions and the actions of his student. None of the pilots involved would have performed any act to risk the reputation of a fellow pilot intentionally.

Failure to issue adequate instructions and delegate authority leads to poor discipline.

A line crewman starting a plane taxied into the wing of another plane, damaging both. The cause of this accident was failure to use wheel chocks—at least that was the cause shown on the reports. The real cause, however, was poor discipline. This mechanic had been instructed in the proper use of the wheel chocks and the field rules called for the use of chocks every time a plane was started.

After the management established the rule, all of the pilots and mechanics adhered to it religiously until one day there was a little pressure. Perhaps the wind died down, or a fog lifted and flight was resumed on short notice. Planes had to be started and warmed up in a hurry to get a complete flight in that day. In the rush, chocks were hurriedly tossed at the wheels instead of being placed securely in front of them. From this hurried start, carelessness grew. Less and less attention was paid to wheel chocks until engines were started without them and without bringing comment or wrath on the guilty party's head.

Not too long ago we had a fire in a hangar. A Piper *Cub* was being worked on in the middle of the hangar surrounded by other planes. This was a routine job and there was no reason why it shouldn't be done in the hangar. During the course of the job, however, the mechanic went for a cotter key and left a burning light bulb resting on the fabric. A fire started but due to good discipline that had been exercised conscientiously during fire drills the fire was confined to the *Cub* and to the wing tip of an adjacent plane.

The fire was the result of poor practice and discipline when the mechanic left the light burning on leaving the job, and when he used an extension cord in a plane without a proper guard, but the serious practice during the fire drills paid big dividends by saving the hangar and its contents.

Have a definite plan to use in event of fire. Use that plan in all fire drills. When you have old fabric to destroy, pull a fire drill. Instruct your personnel in the art of airplane fire fighting. It would be well to have someone from the local fire station on hand to help instruct and offer suggestions on improved methods and equipment for getting a fire out and saving adjacent property. It is hard for anyone who hasn't actually seen a plane on fire to realize just how fast it will burn. If the seriousness of such a fire is demonstrated in practice, perhaps the men will use a few more minutes and be careful when handling things that might create a fire hazard around a plane. Consciousness of fire danger also insures against piling boxes and parts in front of the fire extinguishers so that they are inaccessible.

What can you, as an operator, pilot or mechanic, do to cut down the number of small and costly accidents at your base and prevent the often fatal major accident from occurring? You probably have tried most of the ideas suggested and have had very little success in making them stick. Meetings have been called with personnel and plans outlined—but somehow the plan only seems to work a few days, then the boys go back to the old hit and miss methods.

This failure isn't due to the plan but is the fault of the management. The fact that the plan appealed to you and to your personnel and worked satisfactorily for a few weeks is proof that was a good plan and that it was workable.

If a plan to better your operations is worth putting into effect, isn't it worth spending a little time to keep in effect? As an example, let's suggest a plan to park airplanes which calls for the student and instructor to tie the wings and put chocks in front of the wheels after each flight when the engine is stopped and the plane left unattended. This precaution will prevent the chance of damage due to rolling planes caused by quick winds and line squalls, or the prop blast

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from another plane warming up on the line.

After the meeting, all students are going to tie their planes or place the chocks in front of the wheels properly but as time goes on they will become lax and forget to tie the plane or place the chocks in front of the wheels. It is now time for the line boy to make a notation on a slip stating that he found the plane untied or without wheel chocks and give this slip to the chief pilot for routing to the chief of student control and the head of maintenance. This failure to comply with the rules must then be called to the attention of the personnel involved.

The pilot is responsible for the plane and its safety from the time the ropes are untied until it is tied up again after his last flight. The student is learning to become a pilot and it is important that he learn to share that responsibility. If the plane is damaged he is the one who is going to have to fly poor equipment due to plane shortage. The reports of the failure to comply with regulations and the reports of the accident will be attached to his record. Some day these careless accidents may be the deciding factor in determining his qualifications for a job in aviation.

One operator who has had very good results in putting preventive measures into effect collects nominal fines from the pilot or mechanic involved. The proceeds from the fines are used either for equipment for the instructors' or mechanics' lounge or are used for a party at specified intervals.

Regardless of the method used to enforce the plan, its success will depend entirely on the manager's supervision and ability to catch small and early violations and stop them before they become the rule rather than the exception.

When a line boy props a plane without chocks or with the wheel chocks only partly under the wheels, call him on it and explain that this practice isn't to be tolerated and tell him why. Telling him why is very important. Minor violations of good practice handled promptly and fairly will prevent countless accidents.

Well over 50 per cent of all minor accidents can be traced to lack of proper instruction and discipline. This applies to both experienced and inexperienced help. A man can be a first class instructor, a swell pilot, and a good guy, but if you don't instruct him as to the rules in effect on your field he can't comply with the practices you have set up. Among such questions are: who ties down the plane, who props the plane, what your established procedure is for gassing planes and how often, where to taxi when approaching the parking line, where to stop when approaching the parking line during bad weather to indicate that you desire help on the wing tip.

Explain your fire prevention and fire fighting methods to your pilots and mechanics and see that they are quizzed and drilled in this often enough to be ready when a fire does start.

This does not call for a super manager. It doesn't call for expensive record systems, bonuses, or extra work. It calls for attention to small details. It calls for correcting the little things before they get big, before they can develop into the small costly accidents—the kind that can't happen on your field but do.

Take inventory of your operations today and see how you can improve your safety record by correcting the little things now. Be sure that those under you understand the job you are trying to do. Analyze the dangers and the possibilities of accidents in your department and lay plans to eliminate them. Follow these plans closely every day, all day. Punish for small infractions as quickly as you would for large ones. Do not crack the whip on small accidents unless you are prepared to take part of the blame because you forgot to enforce the small details leading up to the accident. Last, but not least, preach safety and preventive measures, then practice them —all day, every day, and you will have acquired discipline at your operations base. END

Flight and the Right Mental Attitude

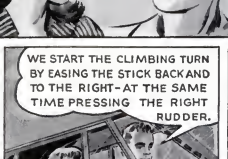
(Continued from page 49)

the student is encouraged to study them, think about them, and analyze them until he understands fully what they mean. It requires a great deal of this analysis for some pilots to succeed in aviation—and often they finally become "aces." This war has proved at least one thing: it is not always the "hot" pilot who makes the best military flyer or the best all-around combat pilot. It is not always the smoothest pylon artist who comes out ahead either. It is safe to go on record with this statement: *the best pilot is he who has had a moderately hard time learning, but who finally adapted himself through recognition of his mistakes, analysis of his shortcomings, and his ability to prevent repetition of his errors.*

Here, then, are some suggestions for what they may be worth in attempting to achieve that end. They have been used by instructors since man began to fly, but in many cases they have been poorly explained or inadequately put across to the student. In many cases the instructor failed to realize that he was, in truth, teaching the *right mental attitude* when he was teaching these points!

First. The first rule is, at first glance, too trite to be of value. It is, "Relax." But wait a moment—just what does it mean when one is told to "relax"? Psychologists have decried the use of this term ever since their advent into aviation several years ago. It has been used and misused by instructors until a student hardly knows the right thing to do when told to relax. Nevertheless, it is the most expressive term we have. It should, therefore, be described and explained fully to a student in order that he may interpret it, understand its full meaning, and put it into practice.

Primarily the command to "relax" is an



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1. Can you buy a Piper Cub on the installment plan, after the war?
   Yes, in much the same way as an automobile.
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3. What is the cost of gas and oil in Piper Cub operation?
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   To the same rigid government specifications as the largest airliner.

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indication of tenseness of mental attitude. There are several factors that produce this condition, but on closer examination they seem to be related to the factor or element of *fear*. Because a student fears, he is anxious, and his anxiety becomes so strong that it overpowers his desire to learn or his ability to receive stimuli. Whether this fear is actual fright such as we feel when in physical danger, or some psychological effect such as fear of failure, seems to make little difference. It has the same result, namely, tenseness.

Suppose, for example, that you are trying to hit a golf ball and that hundreds of people are looking on. Your anxiety to do well, or your fear of failure (which is nearly the same thing) takes so much of your attention that only half an impulse goes out to your body. And any performer will admit that this fear, anxiety, or stage-fright is a definite hazard. It prevents the same impulse from going to the limbs that normally goes out when no one is watching and when no tenseness is present. It can be disastrous in pilots.

The incorrect mental attitude of fear (disregard the kind of fear—its effect is the same) has therefore induced a condition of both mental and physical tenseness. This may be discovered by the instructor when he tests the rudder pedals with brief, infinitesimal pressures. He will find them stiff and resistant; tense students usually hold both feet on the rudders, using it as if to brace themselves. At the same time the stick is grasped in an iron hand, like a shillelagh. Another indication of tenseness may be observed by glancing in the rear view mirror: a tense student will be set, fixed, and often will stare fixedly at the nose or horizon adjacent to the nose. Still others are so dazed and dumb that when something unusual happens they cannot react for many seconds after a normally relaxed person has acted.

It should be observed that many good pilots have had such faults at different stages of training. In fact, the best pilots have overcome such faults. They are the best pilots by virtue of the fact that they *did* overcome them, while the boys who learned too easily were so hot that they killed themselves through sheer ignorance of the things that were beyond their own capabilities or the capabilities of their airplane.

The command to "relax" is a favorite term used by flight instructors. Unfortunately, it is too all-inclusive to be meaningful; yet a keen, well-defined analysis of a student's particular tenseness is not possible. Even if it were possible there is considerable doubt as to the value of going to great lengths in telling a student that "the reason you are tense lies in your psychological anxieties, which in turn constrict your vasomotor area, resulting in considerable inattention to detail." Flight instructors are seldom of the "verbal" type, capable of expressing clearly, in 50-cent words, what they see and desire! Nor are they anxious to go to such lengths in the air, where time is short and temper shorter.

Far better to use the term "relax," provided both instructor and student understand its underlying meanings. Students realize as well as their instructor when they are not relaxed, and often will let go entirely (for a few moments) when told to relax. It must be emphasized, however, that merely telling a student to relax is not enough.

Summed up, each student must be taught to understand the full meaning of the word "relax." Actually it means that he must learn to control his mental attitude in order that he can be relaxed both in mind and body. This will permit him to be at ease, to learn more rapidly, and to absorb the finer details of flight instruction. In overcoming tension he will be prepared for later days, when a long mission or combat might exhaust his strength if he were not relaxed fully and at ease. Difficulty in learning to relax may require self-analysis and self-study to find the why and wherefore of the difficulty. The answer may lie in an innate fear of the instructor. Such students will try to avoid criticism by failing to initiate maneuvers except when they are told. A better student relationship is called for. Let them consider the next rule.

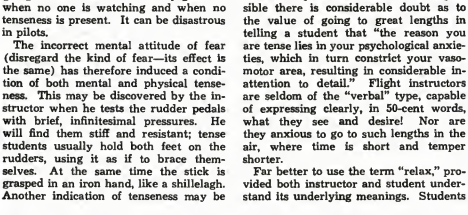
Second. "Fly the plane." The second rule follows logically enough from the first. Some students, mentioned in the last paragraph, fail to initiate action and apparently are not thinking. Often this is due to inadequate or misguided instruction. They are not flying a plane—they are being flown! They must be taught what it means to *fly the plane*.

In other words, "Fly the plane according to a preconceived, perfect idea as to how it should be flown. Don't depend upon someone else, such as the instructor." Students have been known to fly out across open water, towards other aircraft, or to do many foolish stunts merely because they were waiting for signals or advice from their instructor. Nothing could be farther from the correct procedure because instructors are looking for signs of initiative and headwork in their students.

The rule is difficult to impart to a student. If it is stated too badly it appears as if advice were being given which encouraged a student to disregard his instructor. In reality, it means to fly the plane as one's better judgment tells him to fly it. Some instructors say, "Fly the plane to please yourself, not to please me." Naturally they don't want the student to ignore their commands or to land on the wheels instead of a full stall.

What they want to get into the student's mind is the fact that he must have a preconceived notion, as perfect as possible, of what he is going to do. Then he must execute his plan of action from start to finish and forget about the instructor. The instructor is certainly going to make a corrective statement in case of an error, so common sense tells one to go ahead in a firm, convincing manner and *fly the plane*.

This very basic, correct mental attitude is lacking in many students and is often cause for rejection or failure. Not having learned from within, or subjectively, they make their movements mechanically and perfunctorily. This results in their becoming what is commonly



NOVEL TIE-DOWNS

LIGHTPLANES can be parked outdoors in winds up to 90 m.p.h., with the new tie-down system devised by the Hawthorne Flying Service, Columbia, S. C.

The Cubs in the above photograph are tied down in flying position, with their wings at zero angle of attack. The tail wheels are lashed firmly into indented concrete blocks. These blocks are in the form of truncated pyramids, are buried a foot in the ground, rise three and one-half feet above ground, and weigh about 700 pounds each. A piece of rope is attached to each block through a ring. Two ropes, attached at each wing strut end, are used to hold down the wings. These ropes converge at the ground to a single ring embedded in a concrete block.

The planes' wheels are sunk into concrete emplacements whose shape is molded to fit the size of the tire. The wheels sink into these recessions to within an inch of the axle. The wooden fence behind the planes is a 7 ft. 6 in. windbreak.

called a "mechanical flyer." Such a pilot makes his turns and glides over certain landmarks, banks only in one given manner, and goes completely berserk when the routine is changed beyond his limits of mechanical flying.

Obviously the instructor must get his student to understand the second concept by making him realize that he must fly his plane as his inner mind desires, and to shut all consciousness of the instructor out of the picture. As this dovetails closely with the first rule (relaxation and banishment of fear) an understanding of Rule Two will take the student a long way toward achieving the right mental attitude.

Third. "Fly the plane—don't let it fly you."

The third rule is almost identical in phrasing with the second, but this rule concerns the student and his *solo* flying. It has been repeated by instructors until they are literally blue in the gosport. It is a rule that we all have to harp on as long as we fly. It is much different from Rule 2 because, for example, students who solve the problems connected with the second rule and who don't tense up under instruction often let their plane take them around the sky when they get to advanced solo or combat flying.

There is an old adage in the flying game to the effect that "Planes are feminine—fly them or they'll fly you." Any pilot who has tried to land a modern fighter will vouch for this. There is no time to let go in an airplane; somebody has to be boss at every moment and the minute the pilot resigns, the plane takes over.

It is the violator of this adage (and Rule 3) who always wants a second chance after he has failed a flight check. There is hardly a flight failure who is convinced that his washing out was not a stroke of bad luck or that he didn't get the right break. They always feel that "next time it will be different." Perhaps it *would* have been different if they had mastered these rules early enough in their training.

There are countless examples of such mental lapses in the records of both instruction and later flying. Students and pilots alike must continually be alert and ready for the unexpected or they awake to find they have flown off their course, forgotten to lower landing gear, flown over restricted areas, fallen short of their destination because of lack of fuel, and so on.

It is true that such a defect in mental attitude can be overcome but many do not possess the force and will to do it. For lack of a thorough mental housecleaning or certain witlessness in discerning their shortcomings, they fail. But it can be stated again that pilots who *know* their shortcomings and who make proper allowances for them are safer and better than "hot" pilots who either are not aware of or who choose to ignore them.

Fourth. "Do Something."

Less need be said of this rule than the others. It is easier to understand and easier to correct because it is a more tangible error. For students who can't make up their minds, or who just sit there when *something* must be done, there are many good lessons and exercises. But many students have to be taught the correct mental attitude of "Act!" Do something!" The philosophy may be explained by the reasoning that if you just sit there you're apt to be wrong, while if you do *something* you have a fighting chance to be right.

This article is not a plea to get more students through training but rather to improve the training of those whom we do get through. Mental haziness can be licked with training and constant practice. It does not apply to student days alone, but to combat, private, and commercial flying. The day a pilot gets into his plane and chooses to ignore the importance of the right mental attitude is the day he should turn in his wings.

Instructors who have developed a satisfactory S-I (Student-Instructor) relationship will have no difficulty imparting these four philosophies of flight to their students. The lasting and salutary effect of their records in aviation—military or civilian—will be ample reward for those of us who take just pride in our advancing profession. END

Curing the 'Focke-Wulf Jitters'

(Continued from page 33)

the lives of those with whom they serve. Every precaution is taken to recognize such cases and to remove them from active duty. The job is done by the flight surgeon, who recommends the change to the commanding officer. Generally, the commanding officer follows flight-surgeon recommendations.

Incidentally, this brings up one of the heroic aspects of the work. Many flight surgeons have participated in action simply to get the airman's viewpoint. "The typical officer in the AAF Medical Services may be expected not only to accept but also to seek the opportunity for adventurous missions," says General Grant —and seekers are plentiful. An aviation psychologist left his desk in Washington for the front to see how airmen picked on the basis of psychological tests were working out. He wound up flying missions in *Flying Fortresses, Havocs* and *Warhawks.* A flight surgeon parachuted to a station within the Arctic Circle to perform an emergency appendectomy on the camp cook. One psychiatrist flew a series of bomber missions from England to discover how introverts and extroverts react under fire. Another flight surgeon was with Jimmy Doolittle's Tokyo expedition.

These men pioneer the AAF Medical Services, which totaled some 22,000 officers on duty early this year, including 6,000 nurses, 3,800 dentists and 3,000 administrative officers. In addition, there are 70,000 enlisted men, bringing the grand total to nearly 100,000.

Their knowledge of operational fatigue tallies with the experiences of the air-

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men themselves in their influence upon one another and their individual willingness to admit their fears. The flyer has learned to recognize fear as a normal reaction and the group accepts his fears as long as he controls them. He is far better able to control his fears in combat if he understands that they cause operational fatigue. The influence of the group upon the individual can be summed up in one word—leadership.

"Nothing," says General Grant, "contributes more to morale and general health than good leadership." How good AAF leadership is may be gathered from a report by Col. Walter S. Jensen, the deputy air surgeon, who reports that "the morale of the flying personnel in the AAF is of the highest order."

The facts show that fighting men reflect the caliber of their command. General Grant cites the case of a *Flying Fortress* crew observed by a psychiatrist who accompanied them on a mission. The *Fortress's* controls were badly damaged, forcing it out of formation before reaching the target, but the pilot calmly guided it into a successful bomb run. For the next 45 minutes plane and crew were attacked by 100 Nazi fighters. Most of the crew were wounded, three severely. Fire broke out; the tail was almost shot off, wings and propellers were damaged, and a crash landing or a bail-out seemed certain.

But the pilot held on. Easy-going, stable, intelligent—a leader—his personality was reflected in the cool efficient action of the entire crew, many of whom might have broken under poor leadership. Each carried out his assigned duties and obeyed orders.

"Far from exhibiting panic, confusion, faulty judgment, or self-seeking, all were quiet, quick, dependable, loyal, and even cheerful," the psychiatrist reported—"and all got back alive."

Doctors and psychologists report that this type of leadership also contributes strongly to the passionate group loyalty that is one of the outstanding characteristics of every U. S. fighting unit, land, sea or air. It is typified by the pilot whose bomber broke down at the take-off. He rushed through repairs, took off, had to return for more repairs, but finally showed up at the rendezvous as he had promised. It is the same spirit which, in a parallel field, caused a paratrooper who could not make the invasion jump with his buddies to burst into tears.

When airmen do break, operational fatigue sets in. First symptoms are deterioration of flight performance, a feeling of being "washed out." Loneliness, tension, indecision, restlessness, tremors, irritability, insomnia, bring a corresponding loss of weight, appetite, ability to concentrate, confidence, and zest for flying. Severe cases have terrifying battle dreams, feel no ecstasy on returning from missions, suffer as from claustrophobia when flying in formation, often turn back because of imagined engine trouble. They complain of numbness and of feeling like "mechanical men."

Some men try to submerge their anxiety only to become convinced that their number is up. They worry incessantly about the state of their health.

The cure is as dramatic as the cause. The job is to "unwind" the airman's psychological tension and to adjust his disturbing experiences to a rational place in his mental perspective.

Speaking generally, there are two basic steps in the treatment. The first is complete rest, insured, if necessary, by mild sedatives. The second is a mental purge, brought about by psychotherapy in which the psychiatrist interviews the patient and helps him to relieve his mind by drawing out suppressed battle fears and helping him "think his way out" of his mental conflicts.

For example—take the case of the young pursuit-squadron leader who was all right until, on his 25th mission, he saw his wingman go down in flames.

This squadron leader, a highly competitive-spirited captain, was given pentothal and told he was on a strafing mission and that a man on his wing was aflame. With that, the psychiatrist ordered, "Go ahead and talk!" Immediately, the captain shouted, "Pull up and bail out!" Crying and sobbing, he told the whole terrifying experience—how his friend had flown out of wing position to a forward place in the squadron, was hit by flak, burst into flame.

"You have assumed a responsibility for the death of your friend which is not warranted," the physician advised him. In the interviews which followed the patient admitted that his self-blame was unnecessary, that he had taken his responsibility too seriously. Furthermore, he suggested that the reason he felt guilty was because he had refused to give way when his friend tried to break the proper flight formation. After this he was given a second dose of pentothal. During the sleep which it induced, he declared that the reason his friend had veered over to his wing was because he was trying to steal the squadron lead, because they were "jealous" of each other and had been fighting for the same job!

Understanding of the situation restored his self-confidence. The captain now was able to look the past in the face. He was cured and was returned to his flying unit. Having conquered himself, he could now attend to the enemy!

Once the patient has recovered a normal viewpoint, the services proceed to bring him back along the road of convalescence to active duty or to a normal civilian life. In this field has been applied the new "work cure" technique. If the patient is physically capable of it he is promptly encouraged to take an active part in games, therapeutic handiwork, or studies. He must do a certain amount of setting-up exercises daily and he must attend a daily discussion group on current events. Beyond this, he may choose from a large number of useful training courses.

Such a program not only improves morale, but starts the soldier working and thinking in his field of interest and allows him to prepare himself for reassignment in the AAF or, if this is impossible, to prepare for integration to civilian life.

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Teterboro, N.J.

cuperation. Men no longer have time to brood over personal problems or imaginary complaints. One hospital reported that as a result of the program the number of men needing sedatives to get to sleep was reduced from 44 per cent to three per cent. Operational fatigue cases are not the only ones that have benefited. Two groups of pneumonia patients were tested. The first group got the old-fashioned, twiddle-your-thumbs hospitalization. The second got the new, active program. The first group stayed in the hospital an average of 45 days; the active group, only 31 days. Thirty per cent of the inactives had recurrent attacks; only three per cent of the actives were stricken again.

Patients with contagious diseases also hung up records. Hospitalization of measles cases was in one instance reduced from 18 to 11 days; scarlet fever cases were cut from 33 to 23 days. Readmissions were reduced as much as 25 per cent.

"The debt of disability shall be paid in the currency of opportunity," is the program's motto. Outstanding application is the work being done with men who have lost a leg—their exercise is built around the practical problem of getting across streets under normal traffic light conditions. Jigsaw puzzles at bedside tables have been replaced by carburetors, tachometers, altimeters, and radio equipment. Demand for technical books at hospital libraries skyrocketed, detective story demands fell off. Classes in poster art develop pertinent posters for use at the hospital. Other patients learn to take and develop pictures, set type, run mimeograph machines, turn local publicity and develop a hospital newspaper. More than 200 victory gardens have appeared on hospital grounds. A battered jeep was pushed on the hospital junk heap; convalescents promptly restored it to active duty. Chickens served for Sunday dinners are raised by some patients; the new storage buildings at one hospital were built by enthusiastic convalescents.

Where the patient goes when pronounced cured adds to the high morale of those treated. They know that if at all possible they will be returned to their old job. If unfitted for this they will get some other AAF war job. If ready for honorable discharge, they will have the services of the employment machinery of the entire aviation industry, with which the AAF has numberless liaisons, as well as those of the Veterans Administration.

The scope of the program may be gathered from a few facts and figures. More than 30,000,000 man-hours of experience with thousands of patients having hundreds of disabilities and illnesses have been added up. Men returned from combat first are diagnosed at one of three redistribution centers—Atlantic City, which is also headquarters, Santa Monica or Miami Beach. Convalescent centers are located at Coral Gables and St. Petersburg, Fla.; Albuquerque, N. M.; Pawling, N. Y.; Denver, Colo.; Nashville, Tenn., and Fort George Wright, Wash.

Indications are that the program's scope will widen and, with the coming of peace, spread to civilian hospitals throughout the country, adding another effective technique in the eternal war against mental and physical disease and death. END

Why You Get Airsick

(Continued from page 40)

aviation cadets in a recent questionnaire.

Among these 1,000 cases of airsickness, the patients listed the following causes for their illness:

No stunt interval (continuous stunting without rest) was listed by 114 patients; fumes (gas fumes during inverted spins, etc.) were listed by 108; improper food—107; lack of previous training in stunts—87; fear or nervousness—83; insufficient rest—79; not mentally occupied—74; interruptions in training—44; eyes fixed inside the cockpit—40; too many liquids (during hot weather)—38; flying with an instructor—37; poor physical condition—36; warm weather—30; uncomfortable clothing—19; alcoholic excess—18; rough weather—18; loose safety belt—15; eyes not fixed on distant object—15; excessive smoking—11; position in plane—8; position of seat (too high or too low)—5; association (watching someone else be airsick)—4; sandbagging—3; salt tablets—2; hurried meals—2; vomitous fumes—1; poor instruction—1; any autogyration—1.

On the basis of suggestions given by the trainees in the way of treatment, there were instituted a number of precautions which, the Navy reported, have "greatly reduced" the incidence of airsickness at this training station. The precautions included requests to instructors to give a period of relaxation between stunts, give a review of maneuvers to be undertaken in the course, try to establish a feeling of utmost confidence between themselves and the trainees, and allow the probationer pilot to orient himself and become accustomed to the stunt before starting a new one.

Trainees were urged to eat regularly, frequently and in moderation, maintain good physical condition, and keep mentally occupied. Sandbaggers and passengers should try to follow through all stunts, not allowing their eyes to rest too long on the instrument panel.

With this relationship between the eyes and the inner ear in mind, one Naval medical officer—Lieut. T. T. Flaherty—worked out a routine for airsickness sufferers at another Naval station where he conducted a 10-month study of the problem.

"Satisfactory results" were achieved under a program in which the student pilot was instructed to adjust his pilot seat so visibility would be at a maximum, fasten his safety belt as firmly as possible,

POST WAR AVIATION OPPORTUNITIES
Bulletin
VOLUME 1 NUMBER 4

Postwar Employment Promising for Air Force Photographers and Lab Men

Aerial photographers and lab men will find their wartime skill of ready use in postwar employment. In fact, probably no other branch of the air forces has the chance for peacetime employment of its skill that photography has. That is because photography finds so many applications in modern industry.

AERIAL MAPPING

One such application is aerial photography itself. There is a continual need by communities and states for contour maps for dam sites, reservoirs, flood-control systems and highway routes. Aerial pictures are used in grazing and watershed studies, soil conservation and erosion work, forestry surveys and civic planning for regional construction and highway routing.

GEOLOGIC SURVEYS

Mining and petroleum companies employ aerial photography to aid them in exploring new country and making geologic maps. The mosaics identify formations through color changes, attitude and inclination of rocks, etc.

WARNING

Interested personnel should bear in mind that aerial photography, though widely used for many purposes, offers employment to a relative few. One plane can photograph a tremendous area in a short space of time, and established companies do not anticipate any unusual expansion after the war.

OTHER OPENINGS

But there are at least three major divisions of photography which do offer permanent and widespread employment. Portraiture is one such. Commercial photography, with its hundreds of applications such as printing, microfilm recording, advertising and magazine and newspaper make-up, is another.

INDUSTRIAL PHOTOGRAPHY

The third and most recent division is the new, war-born field of industrial photography. Formerly, in making templates for the manufacture of tools and parts, blueprints had to be laboriously drawn by hand on the template. With photography, the same job is done almost instantly and with far greater accuracy.

The blueprint to be transferred is first photographed. Then the metal of the template is sensitized with a special gel, making it in effect a photographic negative. The desired drawing is projected and printed directly onto the sensitized surface. The patterned metal is then ready to be cut into a template.

For example, this process has already saved Lockheed Aircraft Corporation an estimated $7,000,000 in man-hours alone. J. H. Washburn, head of Lockheed's photographic department and a pioneer in industrial photography, believes that this is only the beginning. He estimates that photography can replace 20% of the processes now used in industry.

BRIGHT FUTURE

In fact, professional photography is making such rapid strides that its future applications appear to be limited only by the cameraman's ingenuity.

There will be many opportunities for service-trained personnel to work in the photographic labs of large companies and even more chances for individuals to set up in business for themselves, handling work for companies which find it inexpedient to install their own facilities.

For the ambitious camera or lab man, the postwar world of jobs is wide and beckoning.

The fourth in a series of bulletins designed to acquaint ground and flight personnel of the Army, Navy and Marine Air Corps with new developments in the field of commercial aviation. Union Oil Company does not believe the war is won, but we do think many members of the air forces are wondering what they will do when peace comes. We believe they will be interested to know of any opportunities which exist for them. Inquiries are welcome, and we will be glad to furnish information to interested personnel. Address—Aviation Dept., Union Oil Company, Room 700 B, 617 W. Seventh Street, Los Angeles 14, California.

keep his eyes out of the cockpit at all times except for casual glances at the instrument board, and pick out some distant point of reference. For example, in doing a loop, cadets were advised to fix their eyes at some point on the ground during the initial nose-over. At the top of the loop they should select some point on the horizon and bring the plane down in alignment with this point. The same procedure was suggested for the Immelmann turn. In spins, they should follow points of reference on the ground at all times and never fix their eyes on the wings or nose of the plane. In snap rolls, they were to select a point on the horizon or a cloud bank. They were advised to do wing-overs with relation to a straight stretch of road or fence line and not to try the same type of stunt over and over again because this tended to cause airsickness to a far greater extent than if the stunts were varied—with a short interval between different maneuvers.

Students were also advised never to land a plane if extremely airsick. It is much safer to stay at a reasonable altitude until the airsickness has subsided.

While even veteran flyers are not entirely immune to airsickness, studies by the armed forces have proved conclusively that the incidence of airsickness is directly related to the aerial experience of the individual.

An AAF survey shows that 65 per cent of navigation cadets and about 30 per cent of pilot cadets become airsick in the early stages of their training. But the proportion of trainees washed out by airsickness is relatively small. Airsickness is the cause of eliminating about one to three per cent of all pilot cadets and about 10 per cent of all navigation cadets, according to the U. S. Army Air Forces School of Aviation Medicine. The incidence of airsickness in other branches of air crew training varies between these two extremes.

The AAF determined in studies among airsick trainees that two groups of symptoms comprise the airsickness syndrome —one benign; the other malignant.

It found that 90 per cent of airsick subjects have symptoms which fall predominantly in the benign class, that airsickness of this type does not prohibit successful completion of flying training, and that the symptoms are likely to disappear as the flyer adapts himself to his new environment.

Reactions of those who comprise the benign group were found to be:

"(1) sickness that does not begin until late in flight, usually after one hour, or on landing; (2) sickness occurs only in very rough weather or during violent acrobatics; (3) mild nausea is relieved by vomiting and, though sickness may occur again, the interval between episodes of nausea and vomiting is relatively comfortable; (4) headache, 'dizziness' or difficulty in 'thinking in the air' is not experienced; (5) when not sick, the subject experiences real comfort in the plane; (6) symptoms disappear on landing; (7) signs of adaptation are present, indicating that there is a relative immunity to previously experienced maneuvers, although new ones may cause sickness at first."

About 10 per cent of airsick navigators have symptoms which fall predominantly into the malignant group, and this type of airsickness is responsible for elimination from training.

Among the symptoms in this group, the AAF lists:

"(1) nausea occurs merely on anticipation of flying or begins 10 to 15 minutes after take-off on a smooth day; (2) the nausea is severe and is not relieved by vomiting and consequently sickness lasts through the flight; (3) sickness occurs in smooth as well as in rough weather; (4) mild or severe headache is associated; (5) the hyperventilation syndrome may be experienced; (6) the subject is hypersensitive to unpleasant odors, heat and poor ventilation; (7) symptoms continue, particularly nausea and headache, for four to 72 hours after landing."

About half the men in the malignant group are found to exhibit neurotic trends, while a large proportion of the other half displays strong emotional elements predisposing to airsickness.

The most frequent abnormal features noted in this type, according to the AAF, are fear of flying or of a particular plane; a history of great fear of heights in childhood, occasionally persisting to adulthood; grossly abnormal reaction to the sight of blood; lack of true enthusiasm for flying, and functional gastro-intestinal disorders.

As we have seen, the incidence of airsickness is greatest among trainees. This means that the instructor is called upon to play an important role in the "cure" or prevention of airsickness. A recent AAF manual on airsickness, based on Army studies and on work done by researchers under Dr. Dean R. Brimhall of the Civil Aeronautics Administration, emphasizes that "a person's introduction to flying will have an important bearing upon his ability to withstand airsickness." It cautions instructors not to try to produce airsickness in the cadet, pointing out that "the importance of early attacks is that they prepare the individual for subsequent attacks of airsickness."

It lists a set of "do's" and "don'ts" for instructors, suggesting that earliest flights should be made in smooth air, with a minimum of acrobatics, new maneuvers should be brief until the student becomes familiar with them, and students should be given a thorough explanation of each maneuver in advance—"forewarned is forearmed."

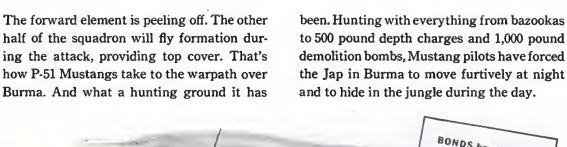
All unnecessary mention of airsickness should be avoided. The instructor must not suggest to the student that he will become airsick. He should be honest with him by not denying that airsickness is possible, but rather by reassuring him that it usually can be avoided and that if it occurs it is rarely chronic. The student must be watched so that if early symptoms of airsickness occur, the flight may be terminated, not only to prevent the more severe symptoms of airsickness but also to prevent waste of time on one who is about to become ill and is therefore unable to concentrate.

An accurate case record should be kept of airsickness. Avoid harsh criticism.

(*Continued on page 130*)

Mustangs on the Warpath

The forward element is peeling off. The other half of the squadron will fly formation during the attack, providing top cover. That's how P-51 Mustangs take to the warpath over Burma. And what a hunting ground it has been. Hunting with everything from bazookas to 500 pound depth charges and 1,000 pound demolition bombs, Mustang pilots have forced the Jap in Burma to move furtively at night and to hide in the jungle during the day.



Like its famous namesake the P-51 Mustang is tough, hard-hitting and elusive.

North American Aviation *Sets the Pace*

PLANES THAT MAKE HEADLINES... *the P-51 Mustang fighter (A-36 fighter-bomber), B-25 and PBJ Mitchell bomber, AT-6 and SNJ Texan combat trainer. North American Aviation, Inc. Member, Aircraft War Production Council, Inc.*

(*Continued from page 128*)

The list is topped off with this blunt observation: "Except in the earliest flights, the development of airsickness in the student during dual instruction is a reflection on the ability of the instructor. *If the instructor were required to clean up the ship after making his student airsick, much less airsickness would* occur."

As for the student, he is advised among other things to try to eliminate all known causes for worry, anxiety and fear, consult his flight surgeon, get plenty of sleep before flying; and to avoid overeating before flying—particularly fatty foods—and alcoholic hangovers.

There has been considerable talk about so-called airsickness pills, but it is generally conceded that no sure-cure drug remedy has yet been found. Experiments have been conducted by the AAF, the Canadians and the British with "remedies" whose common ingredient is hyoscine. It is estimated that drugs are effective in scarcely 50 per cent of the cases, depending upon the individual's reaction, but they are not guaranteed to prevent or cure airsickness.

A Naval aviation medical officer, telling of an experiment with student navigators, said hyoscine was found to be "very effective" as a remedy, but he qualified this by saying that "it depends largely on the nature of the individual and the weather."

At any rate, the services have made great strides in reducing the incidence of airsickness through accurate prognosis and diagnosis; through training selection and constantly improved training techniques. They have developed a hardy, healthy race of airmen who will play an important role in post-war aviation. And, with the common usage of pressurized cabins, greater perfection in airplane design and more frequent plane travel—flying experience—the post-war air traveler can stop worrying about airsickness. END

Beer Bottle Blitz

(*Continued from page 45*)

target for some time and when we ran out of bombs we'd also have all this other stuff with which to annoy the Japanese on the ground.

Seven 300-pound demolition bombs were loaded in the bomb bay and we took on about 75 20-pound fragmentation bombs plus three cases of small four-pound incendiaries. We planned to toss the fragmentation bombs and the incendiaries out the waist windows, together with the junk.

You should have seen the catwalk! It was so jammed that the crew had to crawl over the stuff on hands and knees to get to any forward position.

We went back to our tents to get some shut-eye before take-off time, which was to be around 1030 hours. Crewmen always claimed they couldn't sleep before a raid. But invariably when the operations clerk came around and said, "Okay, fellows, briefing in 15 minutes," the whole bunch of us were completely dead to the world.

I rubbed my eyes and glanced at my watch. It was 1010 hours. I pulled back the mosquito bar and sat on the edge of the bunk a couple of minutes to give the cobwebs a chance to clear. The boys started dressing. There wasn't much to that as each of us only wore Australian khaki shorts and a lightweight flight jacket.

Sometimes we each took along a box of K-rations to eat, but usually we just filled our canteens for a quick drink. Our engineer, T/Sgt. Bob Greenfield, of New York, was the water boy. We had a system for keeping the water cold. Greenfield simply stacked the canteens in the ball turret and the constant slipstream of air coming through did the trick in almost no time at all.

Briefings for such missions were short. Most of us knew the area around Rabaul as well as we knew our own backyards. Personally, I had been on 21 night missions and two daytime missions over this Jap target. Besides the crew, the squadron CO and Intelligence Officer were the only two persons who were present.

Jeeps took us down to the dispersal area, by this time humming with activity. The ground crew and mechanics were scurrying about, performing their various chores by flashlight with amazing efficiency.

Before signalling us into our waiting plane on the airstrip, the

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skipper and engineer started the engines. Because of the excess weight in the plane's tail, crew members crowded as far up front as possible when we did climb aboard for the take-off.

The New Guinea runway we flew from followed a narrow valley between two steeply inclined hills. There were no stars visible that night and all we had to guide us was a searchlight beam on a little island dead ahead which pointed straight up into the sky. We noted from the short range of the light beams that there was a low thick overcast. It looked pretty foreboding.

But we went ahead nevertheless. When the *Fort* reached the beam of light it banked, for the light also served as a marker to tell us when it was safe to turn. We climbed to 18,000 feet to get above the soup, but it was no use. It was worse than a London fog.

At this height we flew across the Owen Stanley Range on instruments. When the navigator decided we were over water and there was no danger of crashing into mountain tops, Captain Thompson, anxious to get out of the fog, dropped down to 2,000 feet.

We thought the weather was bad upstairs but it was twice as rough at lower levels. In disgust, the skipper decided to go lower. We dropped to 500 but it was just as bad.

Of all altitudes, 9,000 feet seemed to be the least stormy. So we stayed at that level. It was by far the worst weather I had experienced on a raid up until then.

An epidemic of airsickness swept the crew. S/Sgt. Les McCormack, who was fusing "frags," turned as green as a clover leaf. From time to time he reached for his oxygen mask and held it over his face, figuring the fresh air would help. It seemed to have some good effect.

Over the interphone system I heard the pilot ask the navigator for a bearing. The navigator said, "I'm so sick, I don't give a damn where we are. Just keep flying straight until I feel better." Thompson replied weakly that the navigator couldn't feel any worse than he did.

About 15 minutes away from the target we ran into clear weather.

Soon the dark shadow of Rabaul appeared below us, silhouetted against the somewhat lighter shade of the surrounding water. The few lights blinking in the enemy village were being rapidly extinguished. We had been spotted!

Then the evening's activity really started. First one finger of light pointed into the sky, then another and another. Soon there were about 50 searchlight beams probing for us. We decided to make our first run without further delay.

We held fragmentation bombs and incendiaries, ready to toss them out the windows. The incendiaries were tied together in clusters of three. When the plane was over the village the bombardier gave us the signal to heave away.

But scarcely had he given us the signal when a searchlight beam caught us. It flicked across the wing and fuselage in a blinding glow. It passed by us and then came back to hold the plane in focus. More searchlights followed suit. We were caught in the glare of some 30 rays. The light was so bright it blinded us for a moment.

When our eyes became adjusted we saw the inside of the craft plenty.

Tracers from 40-mm. automatic guns whizzed past the ship looking very much like strings of red beans. They were accompanied by heavier stuff. The tracers came closer—right by the waist window where I was standing. Every time one passed I felt myself tighten up involuntarily.

We got off 10 "frags" and a few incendiaries before the plane finally flew out of range of the guns. The run took only a few minutes but it seemed like hours.

But this was just the first of 26 bombing runs. We weren't getting away with anything. Our ship reached the target at 0150. We were supposed to stay above it until 0530—and that's just what we intended to do.

The next three bombing runs were much the same as the first. We got off plenty of "frags," scrap, pop bottles and incendiaries. Those Nips knew there was something cooking.

On the fourth bomb run we came in with our bay doors open, ready to drop the 300-pounders. The Japs saw this in the glare of their lights and increased their barrage. Heavy artillery broke so close to us it shook the plane. I could hear pellets rip through the skin of the wings and fuselage. It made a peculiar sound when it burst.

Our demolition bombs started a big fire in the town which rapidly spread to an area about a block wide. The glow from the flames helped us considerably as it served as a bearing point to guide us in the following runs.

The enemy barrage was very heavy up through our 15th run. After that it subsided. On the 14th time around, the waist gunner, a newcomer with the crew was wounded slightly.

McCormack took particular glee in throwing garbage out the window. He yelled over the interphone system, "Lordy, look at them Japs run out after our leavings. You'd think they hadn't eaten in days. Well, our garbage is a darn sight better'n them fishheads for sure."

But after the 15th bomb run the curtain of artillery fire quieted considerably so we daringly went down to 200 feet, masthead level, to buzz the harbor. Thompson turned on the landing lights so we could see some of the area under us. The boys were quick to take a hint. We cut loose with machine gun fire at everything in sight, particularly the searchlight installations which we wanted to disable for the following night's raid.

Lights which had been put out were turned on again. Once more bullets flew around us, so we started to climb. As we passed directly parallel to a searchlight emplacement, T/Sgt. Wes Chadwicke of Los Angeles yanked out his pistol and fired a full clip at it.

We made a few more bomb runs, hanging around the target until it was daylight. Our purpose had been achieved. We had successfully kept those little devils on the run for a whole night. We caused a certain amount of damage but it was nothing compared with the pounding they were going to get from the rest of our gang the next evening.

On the way back to our base we found the weather almost as nasty as it had been when we started out. But we were safer because, minus all the garbage and the bombs, our plane could maneuver with considerably greater ease.

One might think we had enough to last a little while on this raid. But not our gang. Any member of the crew would have been mad as a hornet if someone told him he couldn't go on the 40-plane foray that evening.

So we all made the trip. It was a very successful raid. We practically sank the island—but that's another story. END

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CORPORATIONS, INC. NEWARK, N.J.

PRODUCTION FOR VICTORY — PRODUCTS FOR PEACE

The Thunderbolt

(*Continued from page 34*)

envelope incorporated all the main suggestions that had come up in the conference.

The sketcher was Alexander Kartveli, former Imperial Russian Army officer who had become chief engineer and vice president of Republic Aviation Corp., Farmingdale, Long Island, N. Y. His drawing turned out to be the birth certificate of the *Thunderbolt*.

For "Sascha" Kartveli, the tired-looking yet dynamic Georgian who as a youngster fought for the Czar against the Turks, and at 23 quit revolutionary Russia and landed on his uppers in Paris, that moment was in keeping with the general pattern of a life made up of swift exciting changes—including many an engineering triumph and many a shattered dream. This time the broken dream was the P-44, Kartveli's new high-altitude pursuit which he considered the slickest plane he'd ever designed and which the Army had already approved but now scrapped. Offsetting that disappointment, however, the *Thunderbolt*—which the Army accepted a few weeks later from the completed design—promised Kartveli a big new adventure and a magnificent goal as plans were rushed for its production.

Kartveli got his start with the Bleriot company a quarter of a century ago. Since then his career has been highlighted by his arrival in America in 1927 as personal designer for Charles Levine, the transatlantic "flying junkman" who had spotted him in Paris as an up-and-coming designer, and his appointment four years later as chief engineer of the Seversky Aircraft Co.—forerunner of Republic—at Farmingdale.

Specifically, Kartveli could capitalize on a fighter-building backlog of experience going back to the middle '30's and the P-35, his first contribution to Army combat flying. That plane, developed by Kartveli in co-operation with Maj. Alexander P. de Seversky, then chief of Seversky Aircraft, grew out of a speedy amphibian conceived by de Seversky with special hinged-type floats.

Shorn of its floats when the plane proved too costly to be marketable, the amphibian was converted into the BT-8, an Army land trainer. Then, with the aid of a general "souping up," including a much more powerful engine, it was developed into the P-35. This little plane, with its typical Kartvelian elliptical wings, was in its day a top-flight Army fighter. The force's first all-metal low-wing pursuit, it was also the first Army plane ever to exceed 300 m.p.h. and the first to incorporate flush riveting and retractable landing gear.

But when he returned from Wright Field to Farmingdale that summer of 1940 and plunged into the job of completing a detailed design for the *Thunderbolt*, it was not the P-35 that Kartveli used as a pattern for his basic formulas nor even his beautiful and beloved P-44, which was never built. Instead, in terms of flown and proven aircraft, the real prototype of the *Thunderbolt* was the P-43, or *Lancer*, the efficient little high-altitude pursuit that he had designed in association with de Seversky in the summer of 1939 to succeed the P-35 and which had already been turned out in many hundreds.

A low-wing monoplane like the P-35 but longer, faster and generally bigger than its predecessor, the *Lancer* was the first air-cooled fighter to incorporate the new and revolutionary turbosupercharger to achieve high-altitude flight in atmospheric regions where the air is too thin and oxygen too depleted to permit efficient functioning of engines.

Compared with the P-35, the *Lancer* also had fully instead of partly retractable landing gear and was fitted with a still more powerful engine—a 1,200-h.p. Pratt and Whitney *Wasp*. But the plane suffered from defects that were common to nearly all fighters before the Battle of France—it wasn't fast enough, it was under-armed, and despite the turbosupercharger it still couldn't do its stuff in the highest combat altitudes. Those deficiencies were top on the list of ills that Kartveli had to eliminate in the plane. And this time he was out on his own in the designing job, since his old collaborator, de Seversky, had left the company after a controversy with stockholders the year before.

From an engineering standpoint, the requirements presented some enormous problems. Contrasted with the *Lancer*, here are some of them:

The armament of the *Thunderbolt* was fixed for a start at a record number of eight .50-caliber machine guns, four in each wing—a bristling battery of guns which, if they were fired altogether continuously for one minute, would generate enough energy to lift a battleship clear out of the water. To take care of the enormous loads and stresses set up by such firepower, as well as the weight of many hundreds of rounds of ammunition (the guns and ammunition alone of a *Thunderbolt* weigh almost a ton), required an immense strengthening and consequently a complete redesign of the wings.

Besides the firepower load, the wings also had to be strong enough to support the giant engine—a Pratt and Whitney 2,000-h.p. 18-cylinder *Double Wasp*—chosen for speed and climb. The wings also had to be capable of withstanding the immense strains of high-speed combat, including power dives at speeds that would probably be faster than sound itself.

Those were some of the main problems and here—still using the *Lancer* for contrast—is how Kartveli solved them. First, he boosted the *Thunderbolt* sizes all around. To the wing span he added 5 feet, making it 40 ft. 9 in. He increased the over-all length to 32 feet, making the plane probably the world's longest single-engined fighter. And to take care of various interior changes, many of them secret, he considerably broadened the plane's beam.

All these changes, plus adaptation to the larger engine of the turbosupercharger mechanism, with its intercooler to cool the compressed air before it is forced into the engine, boosted the weight of the *Thunderbolt* to some six and one-half tons, or more than twice that of many other single-engined fighters. That raised intricate aerodynamic problems.

To take care of these, Kartveli slightly raised the wings, making the plane a low mid-wing craft instead of low-wing, like the *Lancer*. He also raised the horizontal tail surface to increase stability and improve anti-spin qualities. And he gave the *Thunderbolt* a four- instead of a three-bladed propeller.

That was the blueprint for the P-47. Translating it into a live fighting aircraft was something else—and the Army was in a hurry. So much so, that it agreed to dispense with the usual mock-up. As a result, the first *Thunderbolt*, the XP-47, was an actual production model and took to the air on May 8, 1941, only eight months to the day after the War Department gave the green light to Republic to go ahead with plans for mass output.

(*Continued on page 135*)

(Continued from page 134)

Since then, Kartveli and his engineers have tackled and licked a raft of difficult production problems of the type that always arise in turning out a new plane. Among the biggest of these was the redesigning of the complicated turbosupercharger mechanism to fit the bigger plane.

Probably the biggest headache in this job was the provision of efficient cooling for the turbine as it was whirled around in the lower rear fuselage by the hot engine exhaust gases. Though this problem had been fully conquered in the *Lancer*, the turbine in the *Thunderbolt* presented a tougher cooling puzzle, for not only was it larger but it also was being worked much harder in order to give still better altitude. The result was that Kartveli had to design a very intricate system of cold air ducts to ensure adequate cooling.

Even then, the problem was far from solved. One illustration will indicate the type of difficulties still faced: it was found that the heat from the exhaust gases, as they passed out of the fuselage after driving the turbine, constituted a hazard to the fuselage. The answer to that one was the ingenious sandwiching of a cold flow of air between the ejected gases and the fuselage.

A no less difficult problem arose as a result of the tremendous stresses experienced in the *Thunderbolt* during powerdives. Torque is compensated for partly by the tail fin structure. But in the *Thunderbolt* with its huge four-bladed prop, so heavy was the torque strain in diving that when the pilots cut the throttle to pull out, and thereby suddenly reduced the stress, the plane developed a dangerous tail whip. This was solved partly by strengthening the tail fin and partly by a new diving technique.

In combat, the *Thunderbolt* has proved itself one of the most rugged and versatile of American fighter planes. Fitted with shackles it has become a fighter-bomber, carrying almost an unlimited assortment of bombs. To its devastating forward firepower of eight .50-caliber machine guns has been added the striking force of aerial rockets. The latest version, the P-47D, has a bubble canopy and a speed of "approximately 450 m.p.h." END

I Learned About . . .

(Continued from page 76)

directly over the finish line. Then I began a normal procedure for the spot landing. It was on the second leg that I noticed the plane had the feel of being in a stalled condition.

Instinctively, I held neutral rudder and shoved the stick forward in order to pick up speed.

Five minutes later I came to—prone on a stretcher!

I'd forgotten that the racing struts had made the nose heavy and when I pushed the stick forward the plane fell like a rock. It had dived in from about 300 feet at a 75° angle. Fortunately, I came through with only a jaw broken in two places, several teeth missing and a cut lip.

Need I say that not since that day 13 years ago have I flown an airplane that was out of rig or balance. END

Fighter Progress in Britain

(*Continued from page 48*)

If these enemy aircraft are put alongside the new British machines it emerges that the Germans have been more progressive but less developmental; more ready to play with highly advanced and revolutionary ideas, less ready to squeeze all the performance possible out of conventional machines.

The *Spitfire XIV* is a natural growth from the prototype *Spitfire* which first flew in March, 1936. My friend, the late R. J. Mitchell, achieved an act of genius in the *Spitfire I*. Put the *Spitfire XIV* against that earlier child of Mitchell's idealistic brain and the aerodynamic advance of eight years is seen to be small.

The thing that makes the *Spitfire XIV* go so much faster and fly so much higher than the *Spitfire I* is the Rolls-Royce *Griffon* 65 engine, which drives a five-bladed Rotol propeller.

Curiously enough, the engine around which Mitchell designed his Schneider Trophy winners of 1929 and 1931, the "R" engine, using special fuel, gave 2,600 h.p. The *Griffon*, which, although founded on the "R" is otherwise entirely new, is officially quoted at "over 2,000 h.p." As fitted to the *Spitfire XIV* it has a two-stage, two-speed supercharger.

The *Spitfire XIV* therefore is a matured, heavier and more powerful *Spitfire I*. In the *Tempest* there is the same story of increased power but no great novelty in the aerodynamic ideas.

The *Tempest* has a wing section which gives a more nearly laminar flow than the *Typhoon* wing, and its designer, Sydney Camm, has done much to overcome compressibility difficulties. But power is its chief advance on the *Hurricane* and the *Typhoon*. The Napier *Sabre* 24-cylinder, liquid-cooled, sleeve valve engine is quoted at 2,200 h.p.

Now compare these two fighters with the enemy products they must meet. Neither of them, in standard form, possesses that necessary margin of speed which, under all conditions, would enable them to intercept and deal with the flying bomb. They both, at times, need height in order to achieve extra speed by diving when they are trying to intercept their quarry and reach a firing position.

Measures were taken to give the *Spitfire* a "sprint" performance for this work against flying bombs. A short-life engine was introduced which still further increased the power and put the *Spitfire XIV* in a better position for coping with flying bombs.

But the flying bomb, at slightly less than 400 m.p.h., keeping on a dead straight course and never taking evasive action, was nearly fast enough to outdistance the best British fighters available when the attack started. Technical men who had been studying intelligence reports before the first flying bombs came to England were of the opinion that the bombs would go too fast to be caught by fighters and they were agreeably surprised when the fighter pilots, by judicious use of height, managed to shoot them down.

Against the jet-driven Messerschmitt Me-262 and the liquid-fuel rocket-driven Messerschmitt Me-163 the effectiveness of the *Spitfire* and *Tempest* is not yet settled. They can deal with the Focke-Wulf Fw-190; but the evidence is that the Me-262 and the Me-163 are a great deal faster than the 190.

In fact, enemy fighters are entering the region around the speed of sound. The Mach number—or ratio of the true air speed of the aircraft to the speed of sound through the air at the same height—must be near unity for the Me-163, and it may be inferred that the Germans have made a thorough study of compressibility and the special problems of sonic and supersonic speeds.

The Me-163, according to the first Royal Air Force pilots to see one at close range, is very small; the wing span being guessed at 30 feet or less. Having an ultra-simple structure, with no horizontal tail surfaces, it should be capable of being turned out in quantity at small cost in money or man-hours.

It may be the vanguard of the intercepter fighters of the future. It is a high jump machine with a rate of climb which, during the acceleration at take-off, must subject the pilot to prodigiously high *g*. There is no reason why the Me-163 should be clumsy on the controls, as was reported in some newspapers, and pilots who have met it state that it can turn quickly when on the glide with the rocket drive cut off.

A warning was given by a senior Royal Air Force officer at a conference held in Belgium that the Germans might become dangerous with their jet and rocket aircraft unless the Allies found it possible to provide new aircraft to oppose them. The tendencies of the air war in western Europe, as it is reported in London, support this view. It follows that there is the utmost urgency about Allied turbo-jet development.

Allied jet fighters are already in action. They will be needed in large numbers if there is an intensification of air fighting in the spring.

Fighting in the air is entering the region of the speed of sound and designers must face many new difficulties. There is great need for some means of protecting the pilot against high *g*. One proposal is to give the pilot a supercharged suit which will grip thighs and abdomen tightly and hold up the blood column under high accelerations.

That is the general fighter situation. We are approaching a fresh battle of speed with jet and rocket drive coming increasingly into the picture and the conventional fighter with piston engine being transferred to bombing and other duties.

Now for the Fleet Air Arm aspect. The special ship-borne fighter represented by the new *Firefly* (the Fairey company has called some of its earlier aircraft by the same name) is a two-seater.

The *Firefly* therefore reverts to the tactical idea first expressed in the *Fulmar*.

(*Continued on page 138*)

Official U. S. Signal Corps Photo

Let these guys start it!

There's a day coming when the enemy will be licked, beaten, whipped to a fare-thee-well—every last vestige of fight knocked out of him.

And there's a day coming when every mother's son of us will want to stand up and yell, to cheer ourselves hoarse over the greatest victory in history.

But let's not start the cheering yet.

In fact, let's not start it at all—over here. Let's leave it to the fellows who are *doing* the job—the only fellows who will *know* when it's done—to begin the celebrating.

Our leaders have told us, over and over again, that the smashing of the Axis will be a slow job, a dangerous job, a bloody job.

And they've told us what our own common sense confirms: that, if we at home start throwing our hats in the air and easing up before the job's completely done, it will be slower, more dangerous, bloodier.

Right now, it's still up to us to buy War Bonds—and to *keep on* buying War Bonds until this war is completely won. That doesn't mean victory over the Nazis *alone*. It means bringing the Japs to their knees, too.

Let's keep bearing down till we get the news of final victory from the only place such news can come: the battle-line.

If we do that, we'll have the *right* to join the cheering when the time comes.

Keep backing 'em up with War Bonds

ZIFF-DAVIS PUBLISHING COMPANY

This is an official U.S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

(Continued from page 136)

The theory may be put thus: in aerial combat between ship-borne aircraft the navigational problems are acute.

The use of radio aids may be limited by the conditions of the sea battle. The combat will drift as the aircraft go through the usual turning maneuvers. It is argued further that a pilot flying alone, who engages the enemy when far from his carrier, cannot hope to keep informed of changes in his position relative to the carrier.

Both are moving and the navigational problems are therefore complicated. So an observer-navigator is carried. He is seated some distance behind the pilot, facing to the rear, and he has no guns.

His duty is to watch the navigation and to make reconnaissance reports. He concentrates on this duty and leaves the pilot free to concentrate on the fighting.

The *Firefly* is maneuverable and has a wide speed range, partly as a result of the Youngman flaps. These flaps, when raised, lie flush with the wing. They are quick acting and the constructing company's engineers claim that they can be used for combat maneuvering somewhat in the manner that the Lockheed *Lightning* quick-acting flaps have been used.

Armament is four 20-mm. cannon, all fixed to fire forward in the line of flight. The engine is again the *Griffon*, but the airscrew is a three-blader.

By adopting the *Firefly*, the Royal Navy reveals that it still clings to the observer-navigator theory for ship-borne fighters. The war in the Pacific is likely to shed light on this theory.

The points may be summarized by saying that the ordinary ship-borne fighter, like the *Seafire* or *Corsair*, has excellent performance in top speed and rate of climb; but that the pilot of the *Firefly* will be in a better position to concentrate on combat and to work to narrower fuel margins.

Meanwhile the Royal Navy, besides putting many United States designed aircraft into service, has adopted the American style of deck catapult. It is expecting to use aircraft up to 30,000-pound weight for deck operation. END

You Will Fly the High Road

(Continued from page 28)

themselves easy targets for flak and enemy aircraft, or fly at high altitudes with the crew all wearing oxygen masks.

Today the *Superforts* can fly in the substratosphere to their targets. As they approach the area of greatest opposition the cabin is depressurized and the airmen don oxygen masks and plug in their heated flying suits. This is a precaution against the cabins being depressurized suddenly by shell fire, distracting the men from the job at hand.

That brings up a question asked frequently, "What happens if a pressurized chamber is suddenly 'deflated?'"

Incredible as it seems, nothing happens.

When the *Superfort* pressurization work was first begun, Maj. H. M. Sweeney of the Wright Field Aero Medical Laboratory, and John Christian, Boeing armament unit chief, asked themselves this question. They decided to find the answer by appointing themselves human guinea pigs.

In the Seattle Boeing plant a *Superfortress* pressurized cabin was set up in a huge pressure chamber to experiment with explosive decompression, such as would occur occasionally under battle conditions. The cabin was pressurized to altitude after the two men had settled themselves inside. And then armament men fired a burst of shots through the cabin. The bullet holes caused almost instantaneous equalization of pressure, but the two men were unaffected. All they noticed was the sudden drop in temperature from the loss of pressure.

Previously, and in an opposite way, Major Sweeney had undergone a more violent test. An experimental pressurized cabin of a *Lightning* was placed within a giant stratochamber. Pressure in the cabin was below 10,000 feet simulated altitude, while the pressure within the stratochamber was run up to 35,000 feet.

Suddenly the taut paper cap separating one pressure area from the other was slashed. When the air rushed from the *Lightning* cabin into the stratochamber, the major was whisked in an instant up to a simulated altitude of 40,000 feet.

His cheeks bulged. His lips flapped uncontrollably. His chest contracted spasmodically as the air was sucked from his lungs. Then, suffering nothing but a momentary breathlessness, Major Sweeney reach for his oxygen mask and put it on. In a few seconds his lungs adjusted themselves to oxygen. The only ill effect was the harmless temporary spasm.

Compressed air from the turbosuperchargers of the *Superfort* inboard engines pressurize their cabins. This air comes off the superchargers at high temperatures and is cooled before it passes through the AiResearch cabin pressure regulator.

This pressure regulator unit is divided into three major component parts so interconnected as to correlate three functions: (1) maintaining an adequate air ventilating flow through the plane, (2) controlling absolute cabin pressures up to safe structural limits of the airplane, and (3) maintaining a differential pressure beyond this point.

Primary part of this unit is the outlet valve and air motor piston (a rubber diaphragm) which controls the air flow. The movement of this valve is controlled by two secondary parts—the absolute pressure regulator and the differential pressure regulator.

The absolute pressure regulator maintains a predetermined constant pressure within a supercharged cabin while atmospheric pressures outside vary with the altitudes encountered. Range on fixed pressure control is called the absolute control range.

In altitudes above the absolute control range, a second overriding control known as the differential pressure regulator, goes into operation. This device allows the

(Continued on page 141)


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● Aviation is changing so fast today that even war pilots with thousands of hours, and veteran aviation mechanics will need advanced training to keep up with its advancements and developments.

The modernly trained man of tomorrow will actually have a greater opportunity in aviation than the veterans who have not kept in step with aviation's rapid strides.

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(Continued from page 138)

pressure inside the cabin to decrease at a constant differential as atmospheric pressures continue to decrease. In other words, it maintains a constant difference between inside and outside cabin pressure, the difference being determined by structural requirements of the fuselage.

This differential control is necessary because at stratospheric altitudes where air pressure is extremely low the great internal pressure tends to "open the seams" of the cabin. At the present time the differential control range extends to 40,000 feet—due to construction of the airplane rather than to limitation of the valve.

For airplanes which are now being designed and built to fly above 40,000 feet, a new control has been developed and added to the cabin pressure regulating unit. This is the constant ratio pressure regulator and it is an overriding control on the differential pressure regulator.

A supercharger is limited at altitudes above 40,000 feet and it cannot produce at full capacity. At this point the constant ratio pressure regulator goes to work. It lowers the cabin pressure to insure that the ratio of absolute pressure in the cabin to the absolute pressure outside the cabin, or the atmospheric pressure, does not exceed the limitations of the supercharger.

The cabin pressure regulator system has four safety check valves. Two of these are not connected with any of the regular air intake or air vent lines. They are the pressure relief valve, which releases air whenever pressure inside the cabin becomes excessive due to failure of the control unit or for other reasons, and the vacuum relief valve, for use in sudden emergency dives, in which it is designed to let air into the cabin to prevent external crushing as the plane plunges down into heavier atmosphere.

The third is a suction release valve, which is a special air intake to the supercharger. If the regular air intake should be shut off by ice or other conditions, the suction release valve brings air in from another, more protected air intake. The unit is complete with a reverse flow check valve, which is used on multiple supercharger installations. If one supercharger becomes disabled, the valve shuts off the airflow line of the supercharger, thus preventing the air from the active supercharger from escaping through the disabled supercharger's line. These regulators weigh only seven and one-half pounds for the mighty task they perform.

Sea level conditions cannot be maintained at all altitudes because it would require too thick a pressure chamber to keep the inside pressure from bursting out of the fuselage. On top of that, aeronautical engineers are constantly laboring to save weight wherever possible.

The Lockheed *Constellation*, which will be one of the first planes to go to commercial airline operators after the war for passenger service, is built to fly only to an altitude of 23,000 feet, with inside pressure regulated to 8,000 feet.

The newly-announced Boeing *Stratocruiser*, however, has been built to operate at altitudes up to 30,000 feet, while maintaining atmospheric conditions inside the cabin equivalent to 8,000 feet. Still another pressurized passenger plane which will come along is the Douglas DC-7, also being engineered for high altitude flying. END

Report from Washington

(Continued from page 44)

S.S. Enterprise

A lot of persons may not take seriously Secretary of State Stettinius' announcement that, because of his family connections with Juan Trippe (and now that Mr. Berle is no longer State's aviation expert), Mr. Roosevelt will henceforth handle matters aeronautical. But maritime interests were inclined to take the announcement very seriously indeed if a story going around Washington is any indication . . . Seems that Schuyler Otis Bland of Virginia, House chairman of the Merchant Marine and Fisheries Committee, promptly called on the President with Rear Adm. Emory S. Land, and told him that Congress would favor a White House move toward letting steamship lines build parallel airlines, steamship-controlled, over their world routes. Seems, also, that the President appeared so receptive that Bland and Land immediately informed steamship interests that things were looking very good indeed. Jubilation followed. But then Bland played another card—would the President confirm his views in writing? The President did—in a four-and-a-half-page letter expounding the idea that the steamship interests should do all right post-war operating only where they are now—in the water.

Warplanes

Don't ask now, because nobody wants to talk, but North American production of *Mitchells* is definitely tapering off, with production stopped at the Inglewood plant and thinned at Kansas City. N.A. isn't too worried, being more than busy with a top-priority project for the AAF . . . War Department has okayed release of the speed in level flight of the *Mustang* —450 m.p.h.—its ceiling, "over 40,000 feet" and its range, 2,000 miles. . . . Speaking of security okays, one of our agents reports that a Chicago war bond show prominently displayed handbook sheets giving data on a number of planes which until now had been restricted, if not secret. So we can now, belatedly, report that the Douglas *Invader* has a wing span of 70 feet, is 51 ft. 2 in. long, top speed over 300 m.p.h., service ceiling 30,800 feet, and carries a .75-mm. cannon if desired. And the Boeing *Superfortress* has a wing span of 141 ft. 3 in., length 99 feet, service ceiling 30,000 feet, top speed, 370 m.p.h.

And Transports

Consolidated Vultee's Model 39 has been junked despite costly preliminary work, futuristic interiors designed by Henry Dreyfus, and the high-wing feature to enable better passenger visibility. Possible reason: a commercial version of the Army B-32 *(Dominator)* may make a much better commercial model . . . It will probably be June at the soonest before Convair's six-engined, 400-passenger C-99 will be airborne on its first flight, which will take place at Lindbergh Field, San Diego, where hangars are being enlarged to take care of the behemoth . . . Aviation, the young upstart, recently taught the boat industry a thing or two when Allied Aviation Corporation of Maryland built bilge-proof hulls for the first time in his-

"I'm warning you, Peters—one more collision and you're through!"

tory. Hulls are of plastic-bonded plywood. Allied has also built and flown a twin-engined, three-place plastic-bonded plywood amphibian.

Russell Aftermath

Who the next manager of the Aeronautical Chamber of Commerce will be is unannounced as we go to press, but this seems certain: when he takes over he will find Chamber morale higher than before Scott Russell put on his master-of-ceremony performance at the Chicago International Conference and then resigned . . . It can now be revealed to the Chamber's credit that the aftermath of the Chicago explosion was handled with surprising dispatch, humanity and skill. It is a little-known fact that Russell was offered a lesser post in the Chamber—not involving master-of-ceremony assignments—and that it was he who chose to sever his connection . . . A spot-check of all Chamber activities showed that in spite of the uproar emanating from Chicago, work was going on as usual, if not at an accelerated pace. Department heads in Washington got together when the bad news broke and decided to keep busy and say nothing . . . So effective was this program that top Chamber leaders promptly reciprocated with a proposal that the future manager of the organization should operate on the policy level only, leaving subordinates far more freedom than ever before to run their own shows. Morale went up correspondingly . . . Donald Douglas is new chairman of the board of ACCA and Gene Wilson is president of the Chamber. Wilson will supervise ACCA activities until a new general manager is appointed. The board has been increased from 15 to 17 members by adding La Motte Cohu of Northrop and Larry Bell of Bell Aircraft . . .

Ambulance Run

E. Jay Doherty looked us up the other day to add a few items to his "Transatlantic Ambulance," which appeared in the last issue of FLYING. It is estimated that TWA brought 8,000 boys home during 1944 and that ATC has evacuated some 100,000 incapacitated men since air ambulance operations began. This does not include other thousands who have been flown from fronts to base hospitals by the Troop Carrier Command. A grand total would run 350,000 or more . . . The transatlantic service has become so efficient that there have been cases where a wounded soldier got first aid from blood flown in by the same transport that took him home on its return trip . . . Behind the figures are enough stories to fill a book. A sample is the one about George Duvall, TWA pilot, whose hobby is cheering depressed passengers on the homeward flight. Recently, one of these was a young combat pilot who had lost a leg and who was uncommunicative and inconsolable. Duvall finally got some background on the boy from other passengers and then, carefully timing it, invited the youngster into the cockpit, where he began to ask a lot of questions. Where was the kid from? Boston. What part of Boston? The kid told him. Duvall then put the jackpot question, timing it down to the second—would the kid like to see his house? The kid said yes and Duvall, putting the plane into a turn, pointed as he gave the jackpot answer: "Well," he said, "there it is."

Briefings

We are doubly pleased with the Collier's award this year to Captain Luis de Florez, the Navy special devices wizard, because he is a favorite of Lieut. Robert L. Taylor, who recently profiled the Captain in the New Yorker; and Lieutenant Taylor, in turn, is a favorite of ours, having added his genius to the confusion accompanying the editing of the recent special Navy issue of FLYING . . . Small towns will get the bulk of the billion-dollar CAA post-war airport program appropriation if Congress approves. More than $339,000,000 will go to towns in the 5,000-to-25,000 population bracket, over $437,000,000 to towns of less than 5,000 . . . Towns and cities of 25,000 up will get some $245,000,000 . . . Best statistical job in aviation of recent issue is the CAA Statistical Handbook of Civil Aviation, which will be distributed in loose-leaf form so that revisions can be inserted as they come out. Credit for the idea goes to the late Roscoe Wright; a rough of the book was one of the last things he did before he died. The work was developed and produced under Ben Stern, current director of information and statistics, ably aided by Floyd B. Brinkley and Stafford Kernan. The book shows, among many other things that, despite wartime restrictions, there were more than 122,000 licensed civilian pilots in the country on January 1, 1944, almost 100,000 of whom held private licenses . . . The Army base at Nome, word drifting back to Washington reveals, is putting the finishing touches on eight two-room suites for Grade A Very Important People. This is in addition to 12 single-room units, with bath, for Grade B VIP's, not to mention better-than-average quarters for many more in the (for Nome) swank officers' club . . . The field, originally built by CAA, may become an international crossroads post-war. Incidentally, CAA personnel now manning communications units at Nome live four couples to a five-room house . . . Civil Aeronautics Board research on international aviation has not abated following the close of the Chicago conference. A series of thorough reports on various aspects of the international situation are already in the works and others are being contemplated. They will be designed to help business men as well as Government officials . . . Watch for this one: most sensational of the studies may concern pre-war international air transport cartels. Although the Board plans to make public only a highly expurgated edition of its cartel findings, it should make meaty reading . . . A mass educational public relations campaign to encourage post-war air travel is the 1945 goal of the Air Transport Association, where Perley Boone is the new public relations counsel. Boone will headquarter in Washington. Bill Raymond will continue at ATA handling legislative matters . . . Boone comes to the association well heeled with a lifetime of newspaper and

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publicity experience. For 20 years he worked with the Chicago *Tribune*, rising to city editor and then becoming New York and Paris correspondent and editor of the *Trib's* ship newspaper. He organized and for three years ran publicity for the New York World's Fair and headed the publicity in the 1940 (pre-Pearl Harbor) conscription drive. He comes to ATA from his most recent post, on the editorial staff of the New York *Times*.

—FRED HAMLIN

Letters

(Continued from page 81)

schools, or flying CPT programs making far better salary than the USAAF offered —and with far less work," she said. But the thing she failed to add was that we were "frozen to our jobs of instructing. The reason was simply that too many instructors wanted to go to the Ferry Command or to apply for a commission in the Naval Aviation branch. The Army Training Command considered us "indispensable." They wooed us tenderly and assured us that when the rush was over they would "take care of us." Well, the Army's idea of taking care of me (and many more) was to offer the choice of becoming a buck private or a civilian. Bear in mind that the slight defects that have grounded us now were not considered detrimental in the least when they needed us.

To accuse men in this situation of being "draft dodgers" is a pretty foul blow. I wonder if all the girls discharged from the WASP are seriously considering enlistment in the WAC, WAVE, or SPAR.

No, the reason we did not protest the inception of the WAFS wasn't that we were making more money and weren't interested in the ferrying jobs. Actually the tax deductions and other benefits allowed military personnel made the net pay of any second lieutenant on flying status higher than that of the average instructor. We did not protest because entrance requirements at that time were sufficiently high that any woman qualifying was obviously a help to the war effort. We did not begin to protest until those requirements were lowered until they became almost a farce.

Miss Poole's use of statistics is also open to question. The most startling of them, unfortunately, deal with the 25 original members of the WAFS which, as we have admitted, comprised highly qualified flyers. The one figure covering the entire organization of "35-hour girls" lists 25 deaths in two years—a figure which Miss Poole dismissed as "phenomenally low." I am sure, on the contrary, that the ATC would consider that average phenomenally high.

I'll gladly agree that there are many outstanding women pilots. But I know, too, that the *average* woman has far less flying aptitude than the *average* man because I've instructed plenty of both. If the women had better safety records than the men, I strongly suspect that it was due to gallantry of operations officers rather than to the superior ability of the women. All the dispatching officers I know would automatically give the least hazardous trips to the girls wherever there was a choice.

In any event, the accident statistics Miss Poole chalks up against the men were taken from records of the entire ferry command. But, remember, not many of our group got into that command. Check the record and you'll find that most of those accidents occurred to young second lieutenants fresh out of school.

This is only a part of our story which the girls should consider honestly. In the meantime, here's an orchid to them for their fight and spirit—and a very sour lemon to whoever is responsible for the Army double deal perpetrated against both the WASP and the War Training Service boys.

ROBERT E. BARRETT
Bremerton, Wash.

Sirs:

Although I am merely a private pilot, I want to register my vote of thanks for your courage in publishing Barbara E. Poole's article on so controversial a subject as the WASP.

During the early part of last summer, my husband was flight supervisor on a CAA-WTS indoctrination program. I, too, worked at the field and am a veteran of many an argument with our male personnel on this same subject. The challenges hurled at me by my male opponents were identical with the ones which Miss Poole so ably refutes.

I'm no ardent proponent of "equal rights," but I do know that women are just as capable of becoming competent pilots as men. If I'm wrong, now is the time for the poor mistreated male pilots to come out with some cold facts proving the contrary.

ELEANOR M. TIPTON
Columbus, Ohio.

Sirs:

On the strength of their performance and record, I compliment the WASP. They have proved conclusively that women are capable flying partners to men. Barbara Poole's "Requiem" told appropriately of a job finished proudly and well.

But the WASP's were doomed from the start. Their disadvantage was in being women and in having to work with men. The competitive spirit was too high, and we men are notoriously poor losers to the weaker sex. With the numerical advantage and with opinion in favor of the men, the WASP's were bound to lose eventually. But they did go down in glorious defeat.

CAPT. D. B. TURNER, AAF
Miami, Fla.

FAMILY CIRCLE

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imagine my surprise and interest at finding a publication that carried so much interesting information about the subject uppermost in my mind.

The color pictures are among the best I have ever seen, and the material pertaining to life aboard a carrier made me feel a little closer to my boy. I shall keep the issue for my son when he returns.

MRS. ARTHUR M. TUBB

Dallas, Tex.

LET'S HAVE FLYING CLUBS

Sirs:

I've just finished reading "What WAS Wrong with Private Flying?" in the September issue. The article cites the high cost of buying and maintaining flying equipment to account for 50 per cent of the many reasons why people discontinued private flying. But it presented no remedy except a possible future reduction in prices through mass production.

Improved manufacturing methods may reduce initial costs somewhat, but that original investment plus insurance costs and hangar rent would still be much too high for the average wage earner. To me, the only effective way of drastically cutting these fixed costs is through the organization of flying clubs. I have been a member of such a club for nearly four years and, besides cutting my flying costs to a mere fraction of what they would have been, membership has enabled me to make several long cross-country flights I could not have made otherwise. In addition, it has made flying much more pleasant through intimate acquaintance with others whose flying interests and experience are much the same as mine.

Your magazine evidently aims at encouraging private flying. I can think of no better way to accomplish that purpose than to publicize the advantages of flying clubs. It is the one method by which people of moderate incomes can enjoy this wonderful sport.

ARNOLD J. NELSON

Washington, D. C.

Rockets and Aircraft

(Continued from page 54)

New combat tactics were developed for the rocket-equipped planes. In France, rocket-firing aircraft ranged ahead of the advancing troops, seeking out and destroying enemy targets in their path. The British used these planes as "free lances," giving them a freedom of action unknown to formations detailed to bomb special targets. They were permitted to range at will within any given area and single out any object considered worthy of attack. In this way, German reinforcements trying to reach battle areas from the rear lines had to struggle in the face of murderous fire over territory with smashed bridges and broken rail lines.

Trains waiting at stations were especially singled out for attack by RAF pilots who aimed their rockets by the simple process of "pointing" their planes in the required direction.

In some cases, co-ordinated attacks were conducted. Thus, when a squadron of *Typhoons* set out to attack a column of tanks on one occasion, the wing commander directed each aircraft to a tank. All dived to the attack and each fired a salvo. Observation showed that at least six of the tanks had been destroyed, set on fire or blasted from the highway.

Fighter pilots adjust their rocket sights according to the angle of the attack and the projectile is fired when the target actually comes into view. The rockets glide forward without recoil or concussion—there is no noticeable sensation.

Rocket launching and firing methods differ between the British and our own Navy and Army Air Forces. The AAF rocket launcher consists of clusters of three paper-plastic or magnesium tubes hung under each wing. The rockets are fired electrically by the pilot who needs only one sight because all the tubes are aligned with the sights of his regular guns.

The entire rocket installation, including the rockets themselves, weighs only 450 pounds per plane and may be jettisoned by the pilot either before or after firing. The installation appears to reduce plane performance but little. The pilot may fire the rockets individually or "in train" with the six projectiles leaving the tubes at one-tenth second intervals.

The first U. S. Navy rocket projectors and installations were similar to those developed by the British, according to "Naval Firepower," published by the Naval Bureau of Ordnance. Instead of the light tubes used on Army planes, the first Navy rocket projectors consisted of a series of rails fitted beneath the wings. There are either three or four projectors under each wing. An aircraft can carry six or eight rockets and is able to fire two at a time or a salvo of all at a single target. The newest Navy projector seems to be little more than a series of hooks, on which the rocket hangs aligned with the fixed forward guns. The rocket is electrically fired.

The rocket projectile is a hollow case or tube, equipped with fins to steady it in flight. It contains an explosive charge in the head and is propelled by the forcible ejection of powder-generated gases from the base. Tubes or rails used to launch rocket-propelled projectiles are merely aiming devices.

The Army's rocket has three main sections—fuse, warhead and "motor." Strictly speaking, the "motor" and the case together comprise the rocket proper, but for practical purposes the entire projectile is referred to as the rocket. In the head of the rocket is a charge of high explosive which is set off by the fuse on impact. The "motor" generates rocket propulsion. Jet gas emerges at high speed from an orifice in the end of the "motor" and propels the projectile forward. The acceleration of the Army's rocket opens six fins or flat steel plates, hinged so they fold into the body of the rocket before projection. The fins, like the feathers of an arrow, give the rocket stable direction.

Besides their explosive charge, rockets

have incendiary characteristics. The gaseous flames set fire to anything inflammable and make the rockets particularly effective against gasoline storage tanks, ammunition dumps and warehouses.

The British rocket case is described as "consisting of a shell tube filled with cordite. The cordite is ignited by a small platinum fuse wire. The consequent flow of gas issuing from the tail propels the rocket forward along the rails in the sighted direction. Four fins are fitted to the traveling end of the rocket for stabilizing in flight."

The rocket propellant is secret. One of the most effective yet known to the Allies, it was developed in Britain and turned over to U.S. Army Ordnance by British authorities. It is now in production in our own middle west and in Britain. After initial demonstrations and exchange of scientific data with an American technical mission, a team of British production experts came to the United States and helped to design, develop and build those rocket propellant plants now in operation.

A $24,000,000 addition is nearing completion at the Badger Ordnance Works, near Merrimac, Wis., for the manufacture of rocket propellant. The powder is also being manufactured at the Sunflower Ordnance Works in Kansas. It is now considered so important that the Army has placed it on the critical list ahead of planes, aviation gasoline, tanks and ships. The Navy is spending at least $100,000,000 per month on rockets—equivalent to its total expenditures on all other ammunition.

The main advantage of the rocket projectile in aircraft has been to eliminate the recoil that heavy-caliber ammunition would ordinarily cause. The recoil shock of large guns has been an important factor in preventing the mounting of weapons larger than 75 millimeter in airplanes so far as is now known.

The gases which propel the rocket are expended beneath the wing surfaces and do not affect the plane, which flies steadily on its course during the firing of successive rounds.

Because the rocket is not fired through a rifled barrel, however, it does not rotate and is subject to the same inaccuracies which affect ammunition fired through a smooth-bore barrel—such as the old-fashioned musket. Another complicating factor is that the rocket has its lowest speed at firing and accelerates constantly thereafter, whereas precisely the opposite is true of a shell fired from a gun. For this reason it is subject to drift deviation and any early errors in aiming are likely to increase disproportionately over a considerable distance. Powder propellants also do not burn uniformly and as the propellant is consumed, the center of gravity shifts, causing the rocket to become more and more nose-heavy.

The fuels used thus far are not considered perfect. Materiel Command experts faced two major problems—suitable fuels and oxidizers, and a nozzle which would stand the terrific heat of the ignited gas. The latter problem has been solved but better combinations of fuels and oxidizers are still being sought.

The AAF Tactical Center reports that a liquid fuel is the most satisfactory yet discovered. It is a mixture of liquid oxygen and frozen alcohol, but because of its loss of power through evaporation it must be supplanted by a more practical fuel.

Our antiaircraft gunners have recently been shooting at "target rockets," which have been in quantity production since December, 1941. The rockets are fired electrically and launched from a wheeled projector. They can be fired from unknown and varied angles and give antiaircraft gunners a realistic opportunity to develop alertness and accuracy. The stabilizing fins of these expendable targets are plywood.

Rockets, too, are being widely used by infantry and artillery personnel in combat. A recent development has been the fitting of multi-barreled rocket guns mounted on "ducks," landing craft and barges in Pacific invasions.

Much more is known about rocket projectiles than about highly secret developments of the rocket airplane. So far as is known, the only rocket-propelled American planes are those to which special rocket boosters have been fitted for assisted take-off. Called JATO, this unit

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(*Continued from page 147*)

basically is a rocket. JATO is a steel cylinder with a jet orifice in the stern. Into the cylinder is packed a propellant. An electrical connection leads to a switch in the pilot's cockpit. First, the pilot guns his internal combustion engines for a normal take-off. As speed picks up he closes a switch, firing the JATO power units. Each JATO unit provides about 300 extra horsepower for a few seconds during take-off and as many as four have been mounted on such planes as the Martin *Mariner*, reducing take-off time from 40 or 45 seconds to 20 seconds.

While the Allied nations may be ahead of the Germans in rocket projectile development, they are definitely behind them in development of rocket aircraft. Besides the highly-touted V-2 rocket bomb, which is a genuine rocket as compared with the jet-propelled V-1, the Germans are flying at least one rocket-propelled fighter plane against Allied aircraft.

It is the Messerschmitt Me-163, (see page 48) which attains speeds considerably in excess of 500 m.p.h. and has a phenomenal rate of climb. The detonation providing driving thrust is created through the controlled mixing of two liquids. The rocket propulsion unit can be switched on and off, the aircraft gliding when the rocket propulsion is not in operation. This unorthodox fighter has a bat-shaped wing and a rudder, but no elevator or horizontal stabilizer.

Though it is a formidable airplane and reported to be quite maneuverable, especially in glides, the Me-163 represents one shortcoming of the rocket-propelled airplane—its comparatively short range. The Me-163 rocket mechanism can be operated for no more than eight to 10 minutes continuously, compared with considerably longer periods for turbo-jet-propelled aircraft. This is because the rocket carries its own oxygen while the turbo-jet engine burns oxygen taken in from the atmosphere. Oxygen comprises the major part of rocket fuel weight.

The Me-163's rocket "motor" may be similar to that which propels the V-2 rocket bomb faster than the speed of sound. The British magazine *The Aeroplane* reports that the fuel sources are ethyl alcohol, hydrogen peroxide, calcium permanganate and small amounts of liquid oxygen. The reaction of liquid oxygen and alcohol produces the jet for launching the rockets. Then a turbine apparatus takes over, producing liquid oxygen which is obtained by a reaction between absolute hydrogen peroxide and calcium permanganate.

If, as is now deemed likely, our present internal-combustion engines will be unable to drive aircraft faster than the speed of sound, the answer is quite likely to be found in the jet- or the rocket-propelled plane. An entirely new and revolutionary conception in both aircraft and in weapons is developing. It demands complete reorientation for the designer, the airline and the pilot. At the highest speeds, conventional methods of propulsion are obsolescent. The future lies, probably, in the jet of hot gas emerging at terrifying rates from the nozzle of a rocket. END

International Air Conference

(*Continued from page 22*)

ports. While not including any traffic rights, this agreement, aside from the Five Freedoms already discussed, marks a great step forward over previous arrangements. It removes one of the former great stumbling blocks in the development of international air transport. Under the pre-war system, both great and small nations had practiced obstructive tactics and shameless exploitation of strategic geographic position. The continuation of such a status generally could only have perpetuated an endless source of irritation in international affairs.

Some 25 nations signed this transit agreement on the last day of the conference and many more indicated their early intention to adhere to it. France, Greece, Netherlands, Poland, Spain and a number of others not already reported as supporting the Five Freedoms Agreement, accepted the two freedoms document. While the United Kingdom, which had been loud in its protestations of willingness to exchange the two freedoms "unconditionally and reciprocally," signed the document, it appended an unexpected reservation that, subject to further notification, its adherence did not cover Newfoundland, an almost indispensable base for North Atlantic crossings. Additional fuel required for flights based elsewhere would cut down payloads correspondingly, imposing additional handicaps.

It was thus with mingled feelings that the delegates of the 51 nations present heard the president of the conference say in his closing address (written before the United Kingdom had made its last-minute reservation), "it is a lasting tribute to the underlying fairness and justice of Great Britain that she proposed and sponsored the general adoption of these (two) freedoms. This meant to her giving up a possible strangle-hold on the Atlantic crossings, which must take off or land at Newfoundland, making it possible for North America to transit the Atlantic Ocean. I am glad to think that on our side acceptance means that in the Pacific, where we hold a like strangle-hold, we have made it possible to connect the great British Commonwealth of Australia and Canada. These freedoms are, of course, available not merely to the United States and Britain and the Commonwealths, but to all nations who come in peace and friendship."

These two fundamental documents dealing with the right to fly and the right to trade are far from being the only major achievements of the conference. A permanent Convention on International Civil Aviation was drawn up which now goes to all states for formal ratification. It lays down the broad principles for the harmonious development of international civil aviation and establishes a base for

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MISCELLANEOUS

common air practice throughout the world. It creates a world organization consisting of a council which is responsible to a periodic assembly of all nations. It designates ways and means for handling disputes that may arise. To this convention are attached drafts of technical annexes covering rules of the air, air traffic control practices, standards governing the licensing of operating and mechanical personnel, airworthiness requirements, communications and customs procedures, and the many other matters on which a large degree of uniformity is desirable.

To come into effect, at least 26 nations must ratify this permanent convention. In the meantime, a provisional international civil aviation organization was established, with its seat in Canada. This organization consists of an interim assembly which is to meet annually, and an interim council of 21 member states elected for a period of two years. It is this interim organization which will guide the development of international aviation in the post-war testing period immediately ahead.

Of the 21 states elected to the first Interim Council, two are from North America: Canada and the United States. Three are from Middle America: Mexico, El Salvador and Colombia. Three are from South America: Brazil, Peru, and Chile. Eight are from the region of Greater Europe: United Kingdom, Netherlands, France, Belgium, Norway, Czechoslovakia, Egypt, and Turkey. Three are from Asia: China, India, and Iraq; and one from Oceania, Australia. India, which failed of election to the council at first, owes her seat to the magnanimous gesture of Cuba, which withdrew to make a place available.

With the signing of this interim agreement on civil aviation, the day of secret diplomacy in the air is past. Each member state undertakes to transmit to the council copies of all existing and future contracts and agreements relating to international air matters. Thus air agreements in the future will be open covenants known to all.

Each state also undertakes to require its international airlines to file with the council traffic reports, cost statistics, and financial statements showing, among other things, all receipts and the sources thereof. Thus a great stream of information will flow to the council where it can be analyzed for the benefit of all.

To the council is assigned the task of administering technical regulations for the common use and benefit of air transport throughout the entire world. The council also acts, when requested, as an arbitral body on any differences arising among member states relating to international civil aviation matters. It has been directed to give continuing study and to report on the matters on which it was not possible for the states represented at the conference to reach agreement, relating particularly to the control of rates, frequencies, and schedules. Thus, it is the interim council, set up by the Chicago Conference, which will very largely determine the immediate future course of international civil aviation.

There are some who express disappointment that unanimous agreement was not reached on the general right to fly and to trade along the world's airways. They overlook the fundamental cleavage which existed, and still exists, between the several points of view represented at the conference. That unanimous agreement was attained, in spite of this basic difference, on a permanent convention on international civil aviation, on an interim agreement, and on many other not altogether incidental matters, is a tribute to all those participating and particularly to the skillful leadership of the conference president, Adolf Berle, Jr. It is for the future to show how well the delegates built at the 1944 Chicago International Civil Aviation Conference. END

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worth waiting for NEWS

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